Distribution, Abundance, and Breeding Activities of the Southwestern Willow Flycatcher at Marine Corps Base Camp Pendleton, California

2007 Annual Data Summary

Prepared for:

Assistant Chief of Staff, Environmental Security
U.S. Marine Corps Base Camp Pendleton

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

Distribution, Abundance, and Breeding Activities of the Southwestern Willow Flycatcher at Marine Corps Base Camp Pendleton, California

By James W. Rourke, Scarlett L. Howell, and Barbara E. Kus

U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

2007 Annual Data Summary

Prepared for:

Assistant Chief of Staff, Environmental Security
U.S. Marine Corps Base, Camp Pendleton
Camp Pendleton, California 92055

San Diego Field Station
USGS Western Ecological Research Center
4165 Spruance Road, Suite 200
San Diego, CA 92101

Sacramento, California
2008

U.S. DEPARTMENT OF THE INTERIOR
DIRK KEMPTHORNE, SECRETARY

U.S. GEOLOGICAL SURVEY
Mark D. Myers, Director

Cover photograph by Scarlett Howell

Recommended citation:

Rourke, J.W., S.L. Howell, and B.E. Kus. 2008. Distribution, abundance and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2007 Annual Data Summary. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Surveys for the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) were conducted at Marine Corps Base Camp Pendleton, California, between 15 May and 15 August 2007. Seventy transient flycatchers of unknown sub-species were observed during Base-wide surveys. Transients occurred on 12 of the 16 drainages surveyed in 2007. No willow flycatchers were detected at De Luz, Horno, Roblar, or Windmill Creeks. Transients occurred in a range of habitat types including mixed willow riparian, willow-sycamore dominated riparian, oak-sycamore dominated riparian, riparian scrub, and upland scrub. The distance from transient locations to the nearest surface water averaged 340 ± 424 m (std, n = 70).

In 2007, the resident southwestern willow flycatcher population on Base consisted of 14 females and 12 males. However, because of within season flycatcher movement, 16 territories were established. One male defended territories in two locations, separated by more than 1 km, pairing with a female in the second location. Another male remained single during the entire 2007 breeding season. In total, 14 females formed pair bonds with 11 male willow flycatchers. Two of the 11 paired males were polygynous with two females each. Based on movement data, two additional males were suspected to be polygynous with neighboring females. All territories were located in mixed willow riparian habitat. Poison hemlock (*Conium maculatum*) was present in all territories. Distance to surface water averaged 168 ± 244 m (std, n = 16), with 69% (11/16) of territories located within 100 m of water.

Nineteen nesting attempts by willow flycatchers were documented during the 2007 breeding season. Nesting was initiated in early June and continued into August. Forty-two percent (8/19) of nests successfully fledged at least one flycatcher young. Predation accounted for 73% (8/11) of nest failures. The other documented cause of nest lost was substrate failure. The cause of failure for two nests was unknown. It is possible that they were depredated in the egg stage or abandoned prior to egg laying, as they failed during the time eggs should have been laid, but no eggs were observed in the nests. Of the 12 pairs whose nests were monitored, 67% (8/12) fledged young. Seventeen fledglings were produced, yielding an estimated seasonal productivity of 1.4 young per pair (17 young/12 pairs). No instances of brown-headed cowbird (*Molothrus ater*) parasitism were observed. Pairs placed nests in five species of plants, including black willow *(Salix gooddingii*), arroyo willow (*S. lasiolepis*), sand bar willow (*S. exigua*), mule fat (*Baccharis salicifolia*), and poison hemlock. Seventy-nine percent of nests were placed in native species.

Ten resident females and 10 males that were banded in previous years were present at Camp Pendleton in 2007. Of the banded adult flycatchers present during the 2006 breeding season, 50% (5/10) of males and 31% (5/16) of females returned to Camp Pendleton in 2007. Thirty percent of those moved to different breeding areas. Eleven percent (3/27) of nestlings banded in 2006 returned to the Base as adults in 2007. These birds included two females and one male (Table 5). All returning second year birds paired and nested in 2007. Thirteen nestlings from six nests were banded in 2007. None of the transients observed during surveys were seen to carry bands; however one transient was caught and banded at the De Luz MAPS banding station on Base.

INTRODUCTION

The southwestern willow flycatcher (*Empidonax traillii extimus*) is one of four subspecies of willow flycatcher in the United States, with a breeding range including southern California, Arizona, New Mexico, extreme southern portions of Nevada and Utah, and western Texas (Hubbard 1987, Unitt 1987). Restricted to riparian habitat for breeding, the southwestern willow flycatcher has declined in recent decades in response to widespread habitat loss throughout its range and, possibly, cowbird parasitism (Wheelock 1912; Willett 1912, 1933; Grinnell and Miller 1944; Remson 1978; Garrett and Dunn 1981; Unitt 1984, 1987; Gaines 1988; Schlorff 1990; Whitfield and Sogge 1999). By 1993, the species was believed to number approximately 70 pairs in California (USFWS 1993) in small disjunct populations. The southwestern willow flycatcher was listed as endangered by the State of California in 1992 and by the U.S. Fish and Wildlife Service in 1995.

Willow flycatchers in southern California co-occur with the least Bell's vireo (*Vireo bellii pusillus*), another riparian obligate endangered by habitat loss and cowbird parasitism. However, unlike the vireo, which has increased six-fold since the mid-1980's in response to management alleviating these threats (USGS Western Ecological Research Center, San Diego Field Station unpubl. data), willow flycatcher numbers have remained low. Currently, the majority of southwestern willow flycatchers in California are concentrated in three sites: the South Fork of the Kern River in Kern County (Schuetz and Whitfield 2007), the Upper San Luis Rey River, including a portion of the Cleveland National Forest in San Diego County (Varanus Biological Services 2001), and Marine Corps Base Camp Pendleton in San Diego County (Kenwood and Kus 2007). Outside of these sites, southwestern willow flycatchers occur as small, isolated populations of one to half a dozen pairs. Data on the distribution and demography of the flycatcher, as well as identification of factors limiting the species, are critical information needs during the current stage of recovery planning (Kus et al. 2003, Kus and Whitfield 2005).

The purpose of this study was to document the status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in San Diego County, California. Specifically, our goals were to (1) determine the size and composition of the willow flycatcher population at the Base, (2) document survivorship and movement of resident flycatchers, (3) document nesting activities, and (4) characterize habitat used by flycatchers. These data, when combined with data from other years, will inform natural resource managers about the status of this endangered species at Camp Pendleton, and guide modification of land use and management practices as appropriate to ensure the species' continued existence.

This work was funded by the Assistant Chief of Staff, Environmental Security, Resources Management Division, Marine Corps Base Camp Pendleton, California.

STUDY AREAS AND METHODS

Field Surveys

All of Camp Pendleton's major drainages, and several minor ones supporting riparian habitat, were surveyed for flycatchers between 15 May and 31 July (Appendix A, Figures 1, 4-9). Field work was conducted by Jason Berkley, Ursula Carliss, Matthew Dresser, Scarlett Howell, Barbara Kus, Eric Nolte, James Rourke, Jennifer Scott, and Mike Wellik. The specific areas surveyed are as follows:

Santa Margarita River: between Stuart Mesa Road and the Base boundary, including Ysidora Basin and Stagecoach Canyon (Appendix A, Figures 4, 5).

De Luz Creek: between the confluence with the Santa Margarita River and the Base boundary (Appendix A, Figure 4).

Roblar Creek: from the confluence with De Luz Creek to a point approximately 1.5 km upstream (Appendix A, Figure 4).

Fallbrook Creek: around Lake O'Neill as well as along the creek between the lake and the Base boundary (Appendix A, Figure 4).

Las Flores Creek: between the Pacific Ocean and a point approximately 800 m upstream of Basilone Road (Appendix A, Figure 8).

Cockleburr Canyon: between the Pacific Ocean and 0.25 km upstream of Interstate 5 (Appendix A, Figure 5).

Horno Canyon: between Old Highway 101 and the upstream limit of riparian habitat (Appendix A, Figure 8).

Piedra de Lumbre Canyon: between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Appendix A, Figure 8).

French Creek: between the Pacific Ocean and the Edson Range Impact Area (Appendix A, Figure 5).

Aliso Creek: between the Pacific Ocean and 0.5 km upstream of the electrical transmission lines (Appendix A, Figure 5).

Newton Canyon: between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Appendix A, Figure 5).

San Onofre Creek: between the Pacific Ocean and the access road to Range 219 (Appendix A, Figures 6, 8).

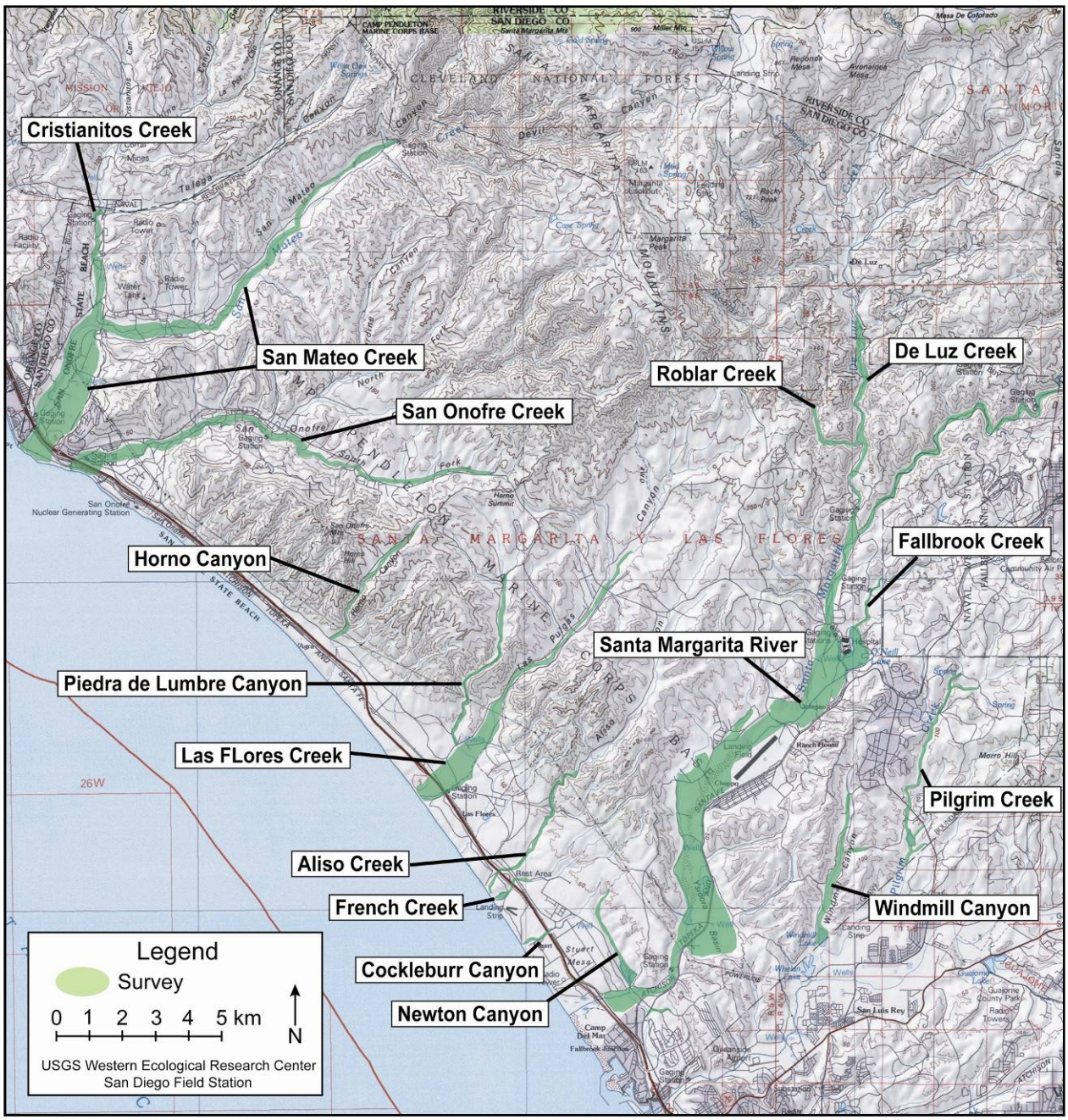

Figure 1. Southwestern willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007.

San Mateo Creek: between the Pacific Ocean and the Base boundary, including habitat south of the creek and south of the agricultural fields (Appendix A, Figure 6, 7).

Cristianitos Creek: between the confluence with San Mateo Creek and the Base boundary (Appendix A, Figure 6).

Pilgrim Creek: between the Base boundary and the limit of habitat upstream of Sewage Treatment Plant 1, including two side drainages between Pilgrim Creek and the southern Base boundary (Appendix A, Figure 9).

Windmill Canyon: from the Base boundary to the golf course entrance (Appendix A, Figure 9).

Drainages were surveyed at least once during each of four consecutive survey periods between 15 May and 31 July. The first period extended from 15 May through 31 May, the second period from 1 June through 21 June, the third from 22 June through 14 July, and the fourth from 15 July through 31 July.

Investigators followed standard survey protocol (Sogge *et al*. 1997), moving slowly (approximately 2 km per hour) through the riparian habitat while searching and listening for willow flycatchers. Observers walked along the edge(s) of the riparian corridor on the upland and/or river side where habitat was narrow enough to detect a bird on the opposite edge. In wider stands, observers traversed the habitat, choosing routes that permitted detection of all birds throughout its extent. Surveys were conducted between dawn and early afternoon, depending on wind and weather conditions.

For each bird encountered, investigators recorded age (adult or juvenile), breeding status (paired, unpaired or transient), and whether the bird was banded. Flycatcher locations were mapped on 1":12,000" aerial photographs as well as 1":24,000" USGS topographic maps, using a Garmin 12 Global Positioning System (GPS) unit with 1-15 m positioning accuracy to determine geographic coordinates (WSG84). Distance to the nearest surface water was recorded for each location, and habitat type was specified according to the following categories based on dominant vegetation:

Mixed willow riparian: Habitat dominated by one or more willow species including *Salix gooddingii*, *S. lasiolepis*, and *S. laevigata*, with *Baccharis salicifolia* as a frequent co-dominant.

Willow-cottonwood: Willow riparian habitat in which *Populus fremontii* is a co-dominant.

Willow-sycamore: Willow riparian habitat in which *Platanus racemosa* is a co-dominant.

Sycamore-oak: Woodlands in which *P. racemosa* and *Quercus agrifolia* occur as co-dominants.

Riparian scrub: Dry and/or sandy habitat dominated by *S. exigua* or *B. salicifolia*, with few other species.

Upland scrub: Coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as *Arundo donax*, *Conium maculatum*, *Brassica nigra*, and *Tamarix ramosissima*.

Percent cover of exotic vegetation at each location was estimated using cover categories of <5%, 5-50%, 51-95% and > 95%, and the dominant exotic species recorded.

Nest Monitoring

Pairs were observed for evidence of nesting, and nests located and monitored following standard protocol (Rourke *et al*. 1999). Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were 3-4 visits per nest. The first visit was timed to determine the number of eggs laid, the next to determine hatching and age of young, and the last to band nestlings. After a nest became inactive, six possible nest fates were assigned based on the following parameters:

(SUC) Successful: Nest fledged at least one young. Fledging was confirmed by detection of young outside the nest.

(PRE) Nest failed as a result of predation: This includes 1) nests seen in the process of ant or other predation, 2) nests found with evidence such as eggshell fragments, feathers, or partially consumed nestlings in or below the nest, 3) nests with eggs or nestlings later found empty and torn from supporting branch, either partially or completely, typically indicative of mammal predation (Peterson et al. 2004), and 4) nests with eggs or nestlings later found intact but empty before the expected fledge date with no evidence of eggs or nestlings on the ground, consistent with snake and bird predation which typically leaves no sign (Peterson et al. 2004).

(PAR) Nest failed as a result of parasitism: This includes 1) nests that were abandoned with one or more cowbird eggs in the nest, and 2) nests that were tended by the host, but contained only cowbird eggs.

(OTH) Nest failed for other reasons that are known: This includes nests that failed for reasons such as host plant failure, surrounding vegetation falling and crushing a nest, inviable eggs that did not hatch after more than two weeks, and human disturbance such as mowing or weed-whacking. Nests that appeared to have failed as a result of cowbird "predation" such as 1) abandoned nests containing punctured eggs in or below the nest, 2) nests where nestlings were killed by a puncture wound to the skull, or 3) nests where nestlings were ejected from the nest and found on the ground were also given this nest fate.

(INC) Incomplete: Nests that were seen under construction, but were never completed.

(UNK) Nest failed for unknown reasons: This designation is used when no other reason could be confirmed. In many instances, the fate "UNK" was assigned to nests that were likely depredated, but because we could not confirm egg-laying did not fit the criteria of the "PRE" fate (above). These are explained more fully in results.

Nest characteristics including height, host species, and host height were recorded following the abandonment or fledging of nests.

Banding

Nestlings were banded at 7-10 days of age. Each bird received a silver aluminum federal numbered band on the right leg. Unbanded adults were captured in mist nets within their territories, and were banded with a numbered federal band on one leg and a solid or bi-colored metal band on the other. Returning second year birds banded as nestlings in 2006, with a single silver aluminum federal numbered band on the left leg, were recaptured in their territories and banded with a colored metal band on the right leg to yield a full, unique combination.

RESULTS

Population Size and Distribution

Transients

Seventy willow flycatchers of unknown sub-species were observed during Base-wide surveys, including one bird caught in a MAPS station net (Howell *et al*. 2008; Appendix B, Figures 10-20). All transients located during surveys were detected between 9 May and 14 June. Transients occurred on 12 of the 16 drainages surveyed in 2007. No willow flycatchers were detected at De Luz, Horno, Roblar, or Windmill Creeks.

Residents

Fourteen females and 12 male flycatchers were detected throughout the breeding season (Appendix B, Figures 10, 18; Appendix C, Figures 21-27). One male remained single and 11 paired during the 2007 season. Two of the 11 paired males were polygynous with two females each (Appendix C, Figures 23-24). Based on movement data (see below), two additional males were suspected to be polygynous with neighboring females (Appendix C, Figures 23). One male (MYS) defended territories in two locations separated by more than 1 km. The male did not attract a female while defending the first location (MYS) and moved to the second location (ETA) where it paired with a female. Overall, 16 territories (i.e., 1 unpaired male, MYS location 1, and 14 female nesting locations) were established in 2007, with 14 females forming pair bonds with 11 male willow flycatchers.

Resident flycatchers were restricted to the Santa Margarita River (Appendix B, Figure 18; Appendix C, Figures 22-27) and lower San Mateo Creek, approximately 2 km upstream of the Pacific Ocean (Appendix B, Figure 10; Appendix C, Figure 21). The detection of a pair of flycatchers on San Mateo Creek was the first record of flycatchers attempting to establish a territory on the drainage. The birds were consistently detected between 8 and 22 June. Although their presence on the drainage was for a relatively short duration, the birds were considered resident because they initiated nesting during this period. Flycatcher distribution on the Santa Margarita River contracted relative to previous years, with no resident birds detected in the Above Hospital breeding area, which was colonized during the 2006 breeding season (Kenwood and Kus 2007), or at Lake O'Neill on Fallbrook Creek which has supported at least one territory since 2000 (Kus 2001, Kus and Ferree 2002, Kus and Kenwood 2003, 2005, 2006a, 2006b,

Kenwood and Kus 2007). Distribution of resident flycatchers within two of the core areas changed little, with the Pump Road and Treatment Ponds sites supporting breeding birds. Two breeding areas were re-colonized by flycatchers: Air Station and Rifle Range in 2007. Two resident pairs were documented within the Air Station site. In 2005, this area was occupied for a short period by a single male (Kus and Kenwood 2006b), but has been devoid of breeding flycatchers since 2004 (Kus and Kenwood 2006a). Two pairs were also documented within the Rifle Range breeding area, adjacent to the Pump Road site. Flycatchers from the Pump Road area have been documented using this location in the past, but 2007 was the first year flycatchers have been documented nesting north of the utility road dividing the Rifle Range and Pump Road locations (Appendix C, Figure 23). Portions of the Santa Margarita River that historically supported resident flycatchers (Vine, central and southern portions of the Bell and Pueblitos areas, the eastern section of Ysidora Ponds, the northern portion of the Rifle Range area, and the Below Hospital breeding area) were either devoid of or supported many fewer flycatcher territories in 2007. Within the core breeding areas (those annually supporting multiple flycatcher territories), the Pueblitos location experienced the most dramatic decline. In 2007, the Pueblitos area supported a single nesting pair; five fewer nesting females and a total of six fewer territories than in the 2006 breeding season. This area had previously supported between 3-7 pairs annually since 2004. No resident flycatchers were detected on Las Flores Creek, which was colonized by a nesting pair in 2003 (Kus and Kenwood 2005) and occupied by a single male in 2004 (Kus and Kenwood 2006a).

Habitat Characteristics

Sixty-four percent (55/86) of all flycatcher sightings occurred in habitat classified as mixed willow riparian, 51% (28/55) of which occurred along the Santa Margarita River (Table 1). Seventeen percent (15/86) of locations were in riparian scrub, dominated by *B. salicifolia* and/or *S. exigua*. An additional 6% (5/86) of birds occupied willow habitat co-dominated by cottonwoods or sycamores. The remaining 13% of the flycatcher detections were in more arid habitats including areas dominated by a mix of sycamores and oaks (1%, 1/86) or upland vegetation (12%, 10/86). No flycatchers were documented in habitats consisting solely of non-native vegetation. While transients used all habitat types, resident flycatchers were found exclusively (16/16) in mixed willow riparian.

Table 1. Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2007.

Bird ID	Drainage	Status[a]	Habitat Type[b]	% Cover Exotics[c]	Dominant Exotics[d]	Distance to Surface Water (m)
AC1	Aliso Creek	T	Mixed Willow	1	-	500
AC2	Aliso Creek	T	Upland Scrub	1	-	25
AC3	Aliso Creek	T	Upland Scrub	1	-	25
AC4	Aliso Creek	T	Riparian Scrub	1	-	500
AC5	Aliso Creek	T	Mixed Willow	1	-	150
AC6	Aliso Creek	T	Mixed Willow	1	-	150
AC7	Aliso Creek	T	Mixed Willow	1	-	150

Table 1 (*continued*). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2007.

Bird ID	Drainage	Status[a]	Habitat Type[b]	% Cover Exotics[c]	Dominant Exotics[d]	Distance to Surface Water (m)
AC8	Aliso Creek	T	Mixed Willow	1	-	60
AC9	Aliso Creek	T	Mixed Willow	1	-	60
CC1	Cocklebur Canyon	T	Mixed Willow	2	NIC	2
CC2	Cocklebur Canyon	T	Mixed Willow	2	NIC	15
CC3	Cocklebur Canyon	T	Mixed Willow	1	-	0
1	Cristianitos Creek	T	Riparian Scrub	3	BRA	2000
94	Fallbrook Creek	T	Mixed Willow	2	TAM	4
95	Fallbrook Creek	T	Mixed Willow	1	-	0
FBG	Fallbrook Creek	T	Mixed Willow	1	-	0
176	French Creek	T	Mixed Willow	1	-	0
177	French Creek	T	Mixed Willow	1	-	230
2	Las Flores Creek	T	Riparian Scrub	1	CON	500
3	Las Flores Creek	T	Riparian Scrub	2	BRA	1000
4	Las Flores Creek	T	Riparian Scrub	2	BRA	400
5	Las Flores Creek	T	Riparian Scrub	2	BRA	160
6	Las Flores Creek	T	Riparian Scrub	1	BRA	750
7	Las Flores Creek	T	Mixed Willow	1	BRA	500
8	Las Flores Creek	T	Riparian Scrub	1	-	1000
9	Las Flores Creek	T	Riparian Scrub	1	-	1000
10	Las Flores Creek	T	Mixed Willow	1	-	1000
11	Las Flores Creek	T	Mixed Willow	1	CON	0
13	Las Flores Creek	T	Mixed Willow	1	-	0
15	Las Flores Creek	T	Mixed Willow	1	-	20
175	Newton Canyon	T	Riparian Scrub	1	-	250
127	Piedre de Lumbre Canyon	T	Upland Scrub	3	BRA	1500
128	Piedre de Lumbre Canyon	T	Upland Scrub	3	BRA	50
129	Piedre de Lumbre Canyon	T	Oak/Sycamore	2	BRA	30
126	Pilgrim Creek	T	Upland Scrub	2	CON	60
130	Pilgrim Creek	T	Mixed Willow	2	BRA	10
131	Pilgrim Creek	T	Mixed Willow	1	-	5
92	San Mateo Creek	T	Mixed Willow	1	-	80
101	San Mateo Creek	T	Willow/ Sycamore	2	BRA	680
102	San Mateo Creek	T	Willow/ Sycamore	2	BRA	520
117	San Mateo Creek	T	Mixed Willow	1	CON	840
118	San Mateo Creek	T	Mixed Willow	1	CON	840
OLI	San Mateo Creek	P	Mixed Willow	1	-	1000
34	San Onofre Creek	T	Mixed Willow	1	FOE	500
62	San Onofre Creek	T	Willow/ Sycamore	1	-	100
68	San Onofre Creek	T	Mixed Willow	1	-	100
111	San Onofre Creek	T	Willow/ Sycamore	1	BRA	1000
12	Santa Margarita River	T	Mixed Willow	1	MEL	0
30	Santa Margarita River	T	Mixed Willow	2	CON	200
31	Santa Margarita River	T	Mixed Willow	2	CON	200
32	Santa Margarita River	T	Mixed Willow	1	-	30

Table 1 (*continued*). Habitat characteristics of willow flycatcher locations at Marine Corps Base Camp Pendleton in 2007.

Bird ID	Drainage	Status[a]	Habitat Type[b]	% Cover Exotics[c]	Dominant Exotics[d]	Distance to Surface Water (m)
63	Santa Margarita River	T	Upland Scrub	1	-	1200
64	Santa Margarita River	T	Upland Scrub	2	CON	1200
65	Santa Margarita River	T	Upland Scrub	2	BRA, CON, TAM	70
66	Santa Margarita River	T	Upland Scrub	2	CON, TAM	70
67	Santa Margarita River	T	Riparian Scrub	1	-	70
69	Santa Margarita River	T	Upland Scrub	2	BRA, CON	500
104	Santa Margarita River	T	Mixed Willow	2	CON	550
105	Santa Margarita River	T	Mixed Willow	2	CON	100
106	Santa Margarita River	T	Riparian Scrub	1	CON	400
107	Santa Margarita River	T	Riparian Scrub	2	CON	330
108	Santa Margarita River	T	Mixed Willow	1	BRA	750
109	Santa Margarita River	T	Mixed Willow	2	CON	500
110	Santa Margarita River	T	Riparian Scrub	1	BRA	500
112	Santa Margarita River	T	Mixed Willow	1	BRA	0
114	Santa Margarita River	T	Mixed Willow	1	CON	5
116	Santa Margarita River	T	Mixed Willow	1	-	0
150	Santa Margarita River	T	Riparian Scrub	1	BRA	70
151	Santa Margarita River	T	Willow/ Sycamore	1	-	230
ALV	Santa Margarita River	P	Mixed Willow	1	CON	75
ARC	Santa Margarita River	P	Mixed Willow	1	-	95
ETA	Santa Margarita River	P	Mixed Willow	2	CON	80
MSL	Santa Margarita River	P	Mixed Willow	1	ARU	200
MYS	Santa Margarita River	S	Mixed Willow	2	CON	450
PIC	Santa Margarita River	P	Mixed Willow	2	CON	10
PIT	Santa Margarita River	P	Mixed Willow	2	CON	80
PLM	Santa Margarita River	P	Mixed Willow	2	CON	110
PNB	Santa Margarita River	P	Mixed Willow	2	CON	150
PRN	Santa Margarita River	P	Mixed Willow	2	CON	75
RIF	Santa Margarita River	P	Mixed Willow	2	CON	80
ROC	Santa Margarita River	P	Mixed Willow	1	-	5
SE1	Santa Margarita River	T	Mixed Willow	1	-	75
SE2	Santa Margarita River	T	Mixed Willow	3	ARU	0
TAR	Santa Margarita River	P	Mixed Willow	2	CON	90
THO	Santa Margarita River	P	Mixed Willow	2	CON	90
TLM	Santa Margarita River	S	Mixed Willow	1	BRA, CON	100

[a] T = transient, P = breeding pair, S = single resident male.

[b] For paired birds, habitat type is assessed within the male's territory boundary, except for those pairs that include polygynous males, in which case habitat type is assessed within the females' use areas.

[c] 1 = <5%, 2 = 5-50%, 3 = 51-95%, 4 = >95%

[d] ARU = *Arundo donax*, BRA = *Brassica nigra*, CON = *Conium maculatum*, FOE = *Foeniculum vulgare*, MEL = *Melilotus alba* , NIC = *Nicotiana glauca*, TAM = *Tamarix ramosissima*.

Exotic vegetation was recorded in 100% (86/86) of flycatcher locations, but was considered the dominant vegetation (percent cover of exotics > 50; Table 1) in only 5% (4/86) of

those sites. All of the exotic-dominated sites were occupied by transient flycatchers. Within resident flycatcher territories, 63% (10/16) were composed of 25-50% exotic vegetation. The only exotic vegetation listed as prevalent within these territories was *C. maculatum*. The most common exotic plants in habitat used by transient flycatchers in 2007 were *C. maculatum*, *B. nigra*, and *T. ramosissima*.

Flycatcher locations differed in their proximity to surface water (Table 1). Locations of resident flycatchers were, on average, twice as close to surface water (168 ± 244 m [std]) compared to transient birds (340 ± 425 m [std]). The majority (69%, 11/16) of resident detections were within 100 m of water, with only two locations farther than 200 m from water. In contrast, 57% (40/70) of transient birds were located more than 200 m from water. This is similar to previous years (excluding the wet year of 2005), when transients were typically 2-4 times as far from water as were residents (Kus and Kenwood 2003, 2005, 2006a, 2006b, Kenwood and Kus 2007).

Breeding Activities

Nineteen nesting attempts by willow flycatchers were documented during the 2007 breeding season (Table 2). Nesting was initiated in early June. The earliest confirmed lay date was 8 June and the latest was 16 July. Five pairs attempted more than one nest, all following an unsuccessful initial attempt. Of the re-nesting pairs, two attempted third nests after two unsuccessful attempts. Nesting continued into August, with the last young fledging on 14 August. Nesting was not documented for the PIT and ALV pairs, because they were located late in the season. Of the 12 pairs whose nests were monitored, 67% (8/12) fledged young during the 2007 breeding season.

In 2007, 42% (8/19) of nests successfully fledged at least one flycatcher young. Predation was believed to be the primary source of nest failure, although no predation events were directly witnessed (Table 2). Predation accounted for 73% (8/11) of nest failures. Overall, 42% (8/19) of completed flycatcher nests were lost to predation. The other documented cause of nest lost was substrate failure. One nest (PIC, nest 1), built in *C. maculatum*, failed when the bract supporting it gave way. The PIC female's second nest was also built in *C. maculatum*. Although this nest was ultimately successful, fledging one young, part of the clutch was lost when the supporting branch failed, dropping a portion of the clutch on the ground. Finally, the cause of failure of two nests (PNB, nest 1, and TAR, nest 1) was unknown. It is possible that they were depredated in the egg stage or abandoned prior to egg laying, as they failed during the time eggs should have been laid, but no eggs were observed in the nest. No cases of partial nest predation were documented.

Mean clutch size, estimated from nine nests known to have full clutches, was 2.7 ± 0.5 eggs. Four nests each contained an infertile egg that did not hatch. Mean brood size, estimated from eight nests containing full broods, was 2.1 ± 0.6 nestlings/nest. Seventeen fledglings were produced, yielding an estimate of seasonal productivity of 1.4 young per pair (17 young/12 pairs).

Table 2. Nesting activity of southwestern willow flycatcher pairs at Marine Corps Base Camp Pendleton in 2007.

Pair ID	Lay Date	# Eggs	# Nestlings	# Fledglings	Nest Fate[d]	Comments
ARC	21-Jun-07	3	2	2	SUC	
ETA	08-Jun-07	3	0	0	PRE	
ETA	27-Jun-07	3	3	3	SUC	
MSL	13-Jun-07	3[a]	3[b]	3[c]	SUC	Nest not located; fledglings confirmed out of nest.
OLI	10-Jun-07	1[a]	0	0	PRE	Egg shells found below nest on ground.
PIC		0	0	0	OTH	Probable cause of failure: substrate failure. Nest located after failure; nest looked complete. Nest found dangling from a hemlock where it was placed on a branch that gave way.
PIC	23-Jun-07	2[a]	2[b]	1	SUC	Nest found on its side with egg shell fragments below nest; one nestling remained in nest.
PLM	13-Jun-07	2[a]	0	0	PRE	Unknown if full clutch; nest possibly depredated during the laying stage.
PLM	27-Jun-07	2[a]	0	0	PRE	Nest placed in hemlock; tilted on side when found.
PLM	16-Jul-07	2	1	1	SUC	One egg did not hatch and was removed.
PNB		0	0	0	UNK	Failed during the time eggs should have been laid, but no eggs were observed in the nest. Possibly depredated or abandoned prior to egg-laying.
PNB	12-Jun-07	3	2	0	PRE	One egg did not hatch and was removed when nestlings were banded.
PNB	16-Jul-07	2	2	2	SUC	
PRN		1[a]	0	0	PRE	Nest intact when found; flycatcher egg shell fragments located below nest.
PRN	02-Jul-07	2	2	0	PRE	
RIF	15-Jun-07	3	3	2	SUC	Third nestling found dead in the nest after two nestlings fledged.
ROC		3[a]	0	0	PRE	
TAR		0	0	0	UNK	Failed during the time eggs should have been laid, but no eggs were observed in the nest. Possibly depredated or abandoned prior to egg-laying.
THO	25-Jun-07	3	2	2	SUC	

[a] Minimum number; eggs not seen or not confirmed to be a full clutch.

[b] Minimum number; nest contents not observed or seen until late in nestling stage.

[c] Minimum number; pair not found until fledgling stage - no nest found.

[d] OTH = Nest failed for other reasons that are known; PRE = Nest failed due to predation; SUC = Nest fledged at least one young; UNK = Nest failed for unknown reasons.

Nest Site Characteristics

Flycatchers placed nests in five species of plants (Table 3), including arroyo willow (*S. lasiolepis*), black willow (*S. gooddingii*), sandbar willow (*S. exigua*), mulefat (*B. salicifolia*), and poison hemlock (*C. maculatum*). Seventy-nine percent of nests were placed in native species: 68% (13/19) in willow and 11% (2/19) in mulefat. Twenty-one percent (4/19) of nests were placed in the exotic species *C. maculatum*.

Table 3. Nest site characteristics of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2007. All measurements are in meters.

					Distance to the edge of:	
Pair ID	**Nest ID**	**Host Species**	**Host Height**	**Nest Height**	**Host Plant**	**Clump**
ARC	1	*Conium maculatum*	2.3	1.4	0.0	1.2
MSL	1	*Salix gooddingii*	8.7	1.8	0.0	3.8
ETA	1	*S. lasiolepis*	9.2	1.3	0.5	0.5
ETA	2	*S. gooddingii*	11.0	3.5	1.5	1.5
TAR	1	*S. gooddingii*	2.9	1.6	0.7	0.7
THO	1	*S. lasiolepis*	9.0	1.2	0.3	0.3
PLM	1	*Baccharis salicifolia*	3.2	1.9	0.0	0.8
PLM	2	*C. maculatum*	2.5	1.5	0.4	0.5
PLM	3	*S. exigua*	3.6	1.7	0.2	2.0
PIC	1	*C. maculatum*	1.8	1.2	0.5	0.5
PIC	2	*C. maculatum*	1.6	1.2	0.6	2.6
PNB	1	*S. lasiolepis*	8.2	-	-	-
PNB	2	*S. lasiolepis*	7.0	1.8	0.9	2.2
PNB	3	*S. lasiolepis*	8.2	1.1	1.4	1.4
PRN	1	*S. lasiolepis*	2.1	1.4	0.0	0.5
PRN	2	*B. salicifolia*	2.7	1.4	1.5	1.4
RIF	1	*S. lasiolepis*	8.0	1.5	0.1	1.4
ROC	1	*S. exigua*	3.5	2.6	0.4	0.5
OLI	1	*S. lasiolepis*	2.1	1.3	0.8	0.8

Successful and unsuccessful nests did not differ statistically in average nest height, height of the host plant, or the distance the nest was placed from the edge of the host (Table 4). However, successful nests were placed significantly farther from the edge of the overall vegetation clump in which they were built; possibly providing greater concealment. For all nests, regardless of fate, nest height averaged 1.5 $\pm$ 0.7 m (std) (n = 19), while host height averaged 5.1 $\pm$ 3.2 (std) (n = 19).

Table 4. Southwestern willow flycatcher nest characteristics and results of two-sample nonparametric Mann-Whitney tests for differences between successful vs. unsuccessful nesting attempts, Marine Corps Base Camp Pendleton, 2007. Sample sizes: successful nests (n = 8), unsuccessful nests (n = 11).

	Nest Fate				
Nest Characteristic	**Successful**	**Unsuccessful**	**R_1 / R_2[a]**	***U*[b]**	***P*[c]**
Average nest height (m)	1.7	1.5	112.0 / 87.0	46.0	0.88
Average host height (m)	6.6	4.1	96.5 / 93.5	27.5	0.17
Average distance to edge of host (m)	0.5	0.5	75.5 / 114.5	48.5	0.71
Average distance to edge of clump (m)	1.8	0.8	107.0 / 83.0	17.0	0.03

[a] R_1 = rank sum of successful nests; R_2 = rank sum of unsuccessful nests.
[b] U = Mann-Whitney test statistic.
[c] P = P-value.

Cowbird Parasitism

All nests were checked for the presence of cowbird eggs. No nest parasitism of southwestern willow flycatcher nests by brown-headed cowbirds was documented in 2007.

Banded Birds

Twelve female and 12 male willow flycatchers were observed closely enough to determine with confidence whether they were banded (Table 5). Eighty-three percent (10/12) of females and 83% (10/12) of males were banded in previous years. Of these, two second-year females and one second-year male that were banded with a single federal band as nestlings in 2006 were recaptured and banded with an additional band to provide unique combinations. All flycatchers with confirmed band combinations were originally banded on Camp Pendleton.

One unbanded adult female was captured and banded with a unique combination. Thirteen nestlings from six nests were banded (Appendix D). All, except three nestling from two nests (one from RIF and two from PNB nest 2), are believed to have fledged. No banded transients were detected during surveys. One transient was caught at the De Luz MAPS station and banded with a silver federal band (Howell *et al*. 2008).

The epoxy and half of the pin-striping employed in making the color-bands used to uniquely identify individual flycatchers was found to have peeled off the PIC female's band. When resighted, depending on the lighting conditions, the exposed silver portion of the band appeared either white or silver. This female was captured to inspect the band. Because the remaining color on the band was in good condition, and the "new" color combination was unique, the band was not changed. Based on resight data, it is believed that the pin-striping on the bands of two other birds had peeled completely off. As was the case for the PIC female, the exposed portion of the band appeared either white or silver depending on the lighting conditions. This resulted in reports of the same color-band combinations (i.e., "whwh : Msi" or "sisi : Msi" depending on lighting) for the female in the RIF territory and the male in the PIC territory. Both birds were target-netted multiple times in an attempt to determine their identity; however, neither was captured. It should be noted that the color combination "whwh : Msi" was placed on what

Table 5. Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2007.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
ALV	P	Unbanded	Msi : -		
ARC	P	Msi : whor	Msi : dgwh	2	Male and female originally banded as nestlings in 2006 (Treatment Ponds area) and color-banded in 2007.
ETA	P	Banded[d]	Msi : oror		Partial resights collected for male of first nest. Male determined to be a different male than male that paired with female for second nest.
ETA	P	orye : Msi	Msi : oror		Male banded in 2006 as an adult (MYS territory). Female banded as a nestling in 2004 (Bell area) and color-banded in 2007.
MSL	P	Banded	pupu : Mdg		Male band combination not determined. Female banded in 2003 as an adult (Pueblitos area).
MYS	S	orye : Msi	NA		Male banded in 2006 as an adult (MYS territory). Male moved to ETA territory part way through the 2007 season.
OLI	P	Unbanded	Unbanded		Male and female disappeared after first nest attempt failed early in season.
PLM	P	Msi : whdg	Mre : -	1	Male for first two nest attempts was not determined. Male for third attempt was polygynous with female at PNB. Male banded in 2006 as an adult (Pump Road area). Female banded as nestling at Pueblitos in 2003.
PIC	P	Banded	Msi : dgsi	1	Male was banded, but colored pinstriping appeared to have peeled off. Female banded in 2004 as a nestling (Bell territory). The female was originally banded Msi : dgdg.
PNB	P	Msi : whdg	yedb : Msi	4	Male banded in 2006 as an adult (Pump Road area). Female banded in 2007.
PIT	P	Undetermined[e]	Undetermined		Male believed to the same bird as PIC male. Not determined if the female was banded.
PRN	P	Msi : rere	Undetermined		Male undetermined for first nest attempt. Male banded in 2005 as an adult (ARC territory). Female not determined if banded.
RIF	P	Msi : yere	Banded	3	Male banded in 2004 as a nestling (Treatment Pond area). Male suspected polygynous with female at ROC territory. Female was banded, but colored pin-striping on band appears to have peeled off.

Table 5 (*continued*). Band status of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2007.

Territory / Bird ID	Status[a]	Male Banded?[b]	Female Banded?[b]	Nestlings Banded?	Comments[c]
ROC	P	Undetermined	Banded		Male suspected polygynous with female at RIF. Resights of female not conclusive.
TAR	P	Mdg : reye	yewh : Msi		Male banded in 2004 as an adult (Pueblitos area). Female banded in 2005 as a nestling (Bell area). Male polygynous with female at THO territory.
TLM	S	Banded	NA		Resights not conclusive.
THO	P	Mdg : reye	Msi : redg	2	Male banded in 2004 as an adult (Pueblitos area). Female banded in 2006 as a nestling (Pueblitos area). Male polygynous with female at TAR territory.

[a] P = pair, S = single male.
[b] Band combinations: left leg : right leg; Msi = federal aluminum band, Mdg = anodized green federal band, Mre = anodized red federal band. *Metal bands:* dgdg = dark green, dgsi = dark green-silver split, dgwh = dark green-white split, oror = orange, orye = orange-yellow split, pupu = purple, redg = red-dark green split, rere = red, reye = red-yellow split, whdg = white-dark green split, whor = white-orange split, yewh = yellow-white split, yedb = yellow-dark blue split, yere = yellow-red split.
[c] See Figures 2, 3; Appendix B, Figures 10, 18; Appendix C, Figures 21-27 for breeding area and territory locations.
[d] Banded = bird was determined to have been banded, but its exact color-band combination was not determined.
[e] Undetermined = not determined if the bird was banded.

was believed to be a transient flycatcher of unknown sex at the De Luz MAPS station on 6 June 2006 (Howell *et al*. 2007). It is possible, although we believe less likely, that either the RIF or PIC birds is the flycatcher originally banded with the "whwh : Msi" combination. This belief is based on the fact that the bands on both birds periodically appeared silver, similar to a blank aluminum band, and that all other willow flycatchers (n = 10) banded at the De Luz MAPS station over the last 11 years appear to have been migrating birds, as they have not been resighted on Base after their initial banding.

Survivorship, Site Fidelity, and Movement

The recapture and resighting of banded birds allowed us to determine the rate at which flycatchers previously documented on Base returned to hold territories in 2007. Although this is the minimum number of flycatchers known to survive, and does not include birds that dispersed off Base or that we may have failed to detect/resight, it can be used as an inference to calculate minimum annual survivorship for the flycatcher population on Base. Of the uniquely banded adult flycatchers present during the 2006 breeding season, 50% (5/10) of males and 27% (4/15) of females returned to Camp Pendleton in 2007. Overall, adult survivorship from 2006 was 36% (9/25). Return rates were calculated based on banded birds with confirmed, unique color-band combinations, and did not include four male and two female flycatchers that were known to be banded, but whose exact color combinations could not be determined. It is probable that most, if not all, of these birds were originally banded on Base, and were present during the 2006 breeding season. This estimate also excludes a female flycatcher (ETA) that possessed a single federal

band (i.e., Msi : -) at the beginning of the 2007 breeding season. A female with the same band combination has nested within the ETA area since 2005, but until this season had avoided recapture. It cannot be confirmed, but is likely, that the same female has returned each year to nest in the ETA area since 2005. If these birds are incorporated into calculations of return rate, an optimistic estimate of the total adult return rate is 62% (16/26), with revised male and female return rates of 90% (9/10) and 44% (7/16), respectively.

Three of the 27 nestlings banded in 2006 that survived to fledge were resighted and re-captured at Camp Pendleton in 2007, yielding an estimate of first year survivorship of 11%. These birds included two females and one male (Table 5). All returning second year birds paired and nested in 2007.

Willow flycatchers at Camp Pendleton generally settle into breeding concentrations or areas where groups of birds establish territories (Figures 2, 3). Resighting banded birds allowed us to identify individuals that returned to the same area they used the previous year. In 2007, 6 of the 10 banded returning adults (60%, including the ETA female that was originally banded with a single federal band) returned to the breeding area they had occupied in 2006 (Table 6). All adult flycatchers (three males and three females) either returned to the same territories they previously occupied, or occupied a territory that encompassed a portion of the area they defended previously. Of the 10 banded adults detected at Camp Pendleton in 2006 that returned to the Base, three (30%) dispersed to different breeding areas within the Santa Margarita River in 2007 (Table 6, Figure 2). Of these three, two were male and one was female. All three dispersed from the east to the west side of the Santa Margarita River. The two male flycatchers dispersed from the Pueblitos area to the Pump Road and Rifle Range sites, approximately 0.5 and 1.5 km distant, respectively. The female dispersed from the Treatment Ponds area to the Pump Road site, approximately 0.4 km away. The average distance dispersed by adult flycatchers between the 2006 and 2007 breeding seasons was 0.8 ± 0.6 km.

In contrast to returning adults, none of the three returning second year birds banded as nestlings in 2006 returned to their natal areas to breed. One female, banded as a nestling at Pueblitos, dispersed to the Treatment Ponds, approximately 0.3 km away (Table 6, Figure 2). The remaining female and male flycatchers were banded in adjacent territories in the Treatment Ponds area and dispersed to the Air Station, approximately 1.4 km distant, where they paired with each other in 2007. The average distance that second year birds dispersed from their natal areas was 1.0 ± 0.6 km.

Table 6. Between-year, between-area movement of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2007.

Year Last Detected	Area[a] (Territory) Last Detected	Area (Territory in 2007)	Dispersal Distance (km)	Band Combination[b]	Age in 2007	Sex[c]
2006	Treatment Ponds (TOR)	Air Station (ARC)	1.4	Msi : whor	1 yr	M
2006	Ysidora Ponds (MYS)	Ysidora Ponds (MYS)	0	orye : Msi	≥ 2 yrs	M
2006	Pump Road (PRM)	Pump Road (PLM / PNB)	0 to 0.1	Msi : whdg	≥ 2 yrs	M
2006	Pueblitos (ETA / EDY / ETC)	Pump Road (PRN)	0.4 to 0.5	Msi : rere	≥ 2 yrs	M
2006	Pueblitos (EMY / EPC / ERN)	Rifle Range (RIF)	1.4 to 1.6	Msi : yere	3 yrs	M
2006	Treatment Ponds (TAR)	Treatment Ponds (TAR / THO)	0	Mdg : reye	≥ 4 yrs	M
2006	Treatment Ponds (TAR)	Air Station (ARC)	1.3	Msi : dgwh	1 yr	F
2004	Bell (BLH)	Pueblitos (ETA)	2.8	Msi : oror	3 yrs	F
2006	Ysidora Ponds (MSL)	Ysidora Ponds (MSL)	0	pupu : Mdg	≥ 5 yrs	F
2006	Pump Road (PRM)	Pump Road (PLM)	0	Mre : -	4 yrs	F
2006	Treatment Ponds (TOR)	Pump Road (PIC)	0.4	Msi : dgsi	3 yrs	F
2006	Treatment Ponds (TAR)	Treatment Ponds (TAR)	0	yewh : Msi	2 yrs	F
2006	Pueblitos (EDY)	Treatment Ponds (THO)	0.3	Msi : redg	1 yr	F

[a] See Figure 2, Appendix B, Figure 18; Appendix C, Figure 22-27 for breeding area and territory locations.

[b] Band combinations: left leg : right leg; Msi = federal aluminum band, Mdg = anodized green federal band, Mre = anodized red federal band. *Metal bands:* dgsi = dark green-silver split, dgwh = dark green-white split, oror = orange, orye = orange-yellow split, pupu = purple, redg = red-dark green split, rere = red, reye = red-yellow split, whdg = white-dark green split, whor = white-orange split, yewh = yellow-white split, yere = yellow-red split.

[c] Sex: M = male, F = female.

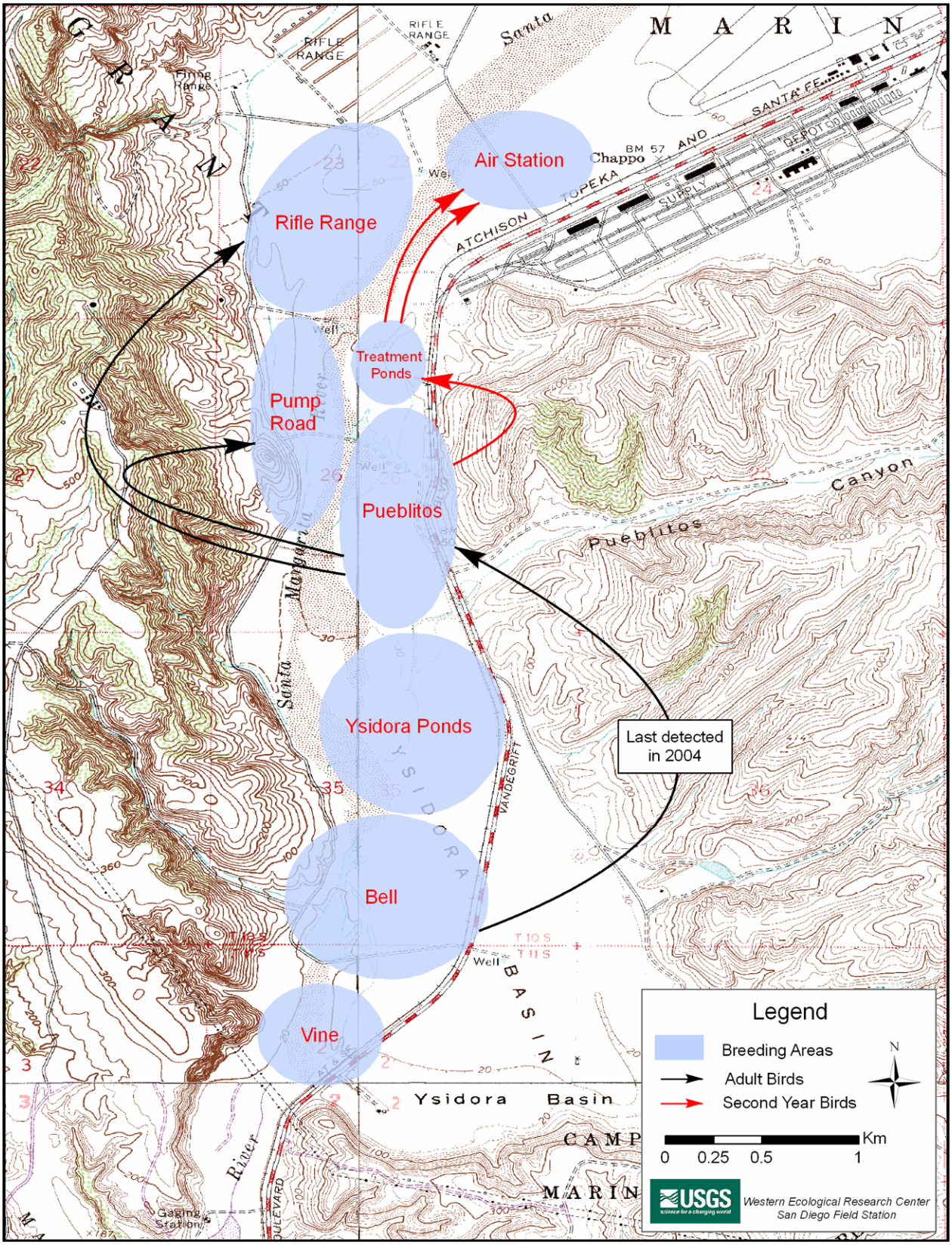

Figure 2. Between-year, between-area movement by adult and second year southwestern willow flycatchers at Marine Corps Base Camp Pendleton, 2007.

Four instances of movement by adult southwestern willow flycatchers were observed during the 2007 breeding season (Table 7, Figure 3). All movements occurred within the first three weeks of June. The first dispersal event involved the female nesting in the TAR territory. This female was not detected in the TAR territory after its first nesting attempt failed on 10 June. It was observed again almost two months later on 6 August in the PNB territory. It is possible that this female attempted to nest in the PRN territory, adjacent to the PNB territory, as the band combination of the female from the PRN territory was not confirmed. The second movement occurred when the pair on San Mateo Creek dispersed after their first nest attempt was depredated on 11 June. These birds were not detected again for the remainder of the breeding season. The third movement event precipitated the fourth event when the unpaired male from the MYS territory dispersed approximately 1.1 km north to the ETA territory and displaced the resident male that was associated with the first nesting attempt within the ETA territory. The MYS male paired with the ETA female and eventually fledged three flycatcher young. The displaced bird was not detected again during the course of the 2007 season.

Table 7. Within-year, between-area movement of southwestern willow flycatchers at Marine Corps Base Camp Pendleton in 2007.

Area[a] (Territory First Detected)	Area[a] (Territory Later Detected)	Distance Moved (km)	Band Combination[b]	Age	Sex[c]	Status[d]
Treatment Ponds (TAR)	Pump Road	0.4	yewh : Msi	2 yrs	F	P
Comments: This bird was not detected in the TAR territory after its first nesting attempt failed on 10 June. It was observed again late in the season on 6 August in the PNB territory.						
San Mateo (OLI)	Not seen again	NA	Unbanded	≥ 1 yr	M and F	P
Comments: Pair not detected after the first nesting attempt failed on 11 June.						
Ysidora Ponds (MYS)	Pueblitos (ETA)	1.1	orye : Msi	≥ 2 yrs	M	S
Comments: This bird was last seen at MYS on 15 June and first detected at ETA on 20 June.						
Pueblitos (ETA)	Not seen again	NA	Banded	≥ 1 yr	M	P
Comments: The band combination of this bird was not confirmed before it disappeared, after its first nesting attempt failed.						

[a] See Figures 3; Appendix B, Figures 10, 18; Appendix C, Figures 21, 23-26 for breeding area and territory locations.

[b] Band combinations: left leg : right leg; Msi = federal aluminum band. *Metal bands:* orye = orange-yellow split, yewh = yellow-white split.

[c] Sex: M = male, F = female.

[d] Status: P = breeding pair, S = single resident male.

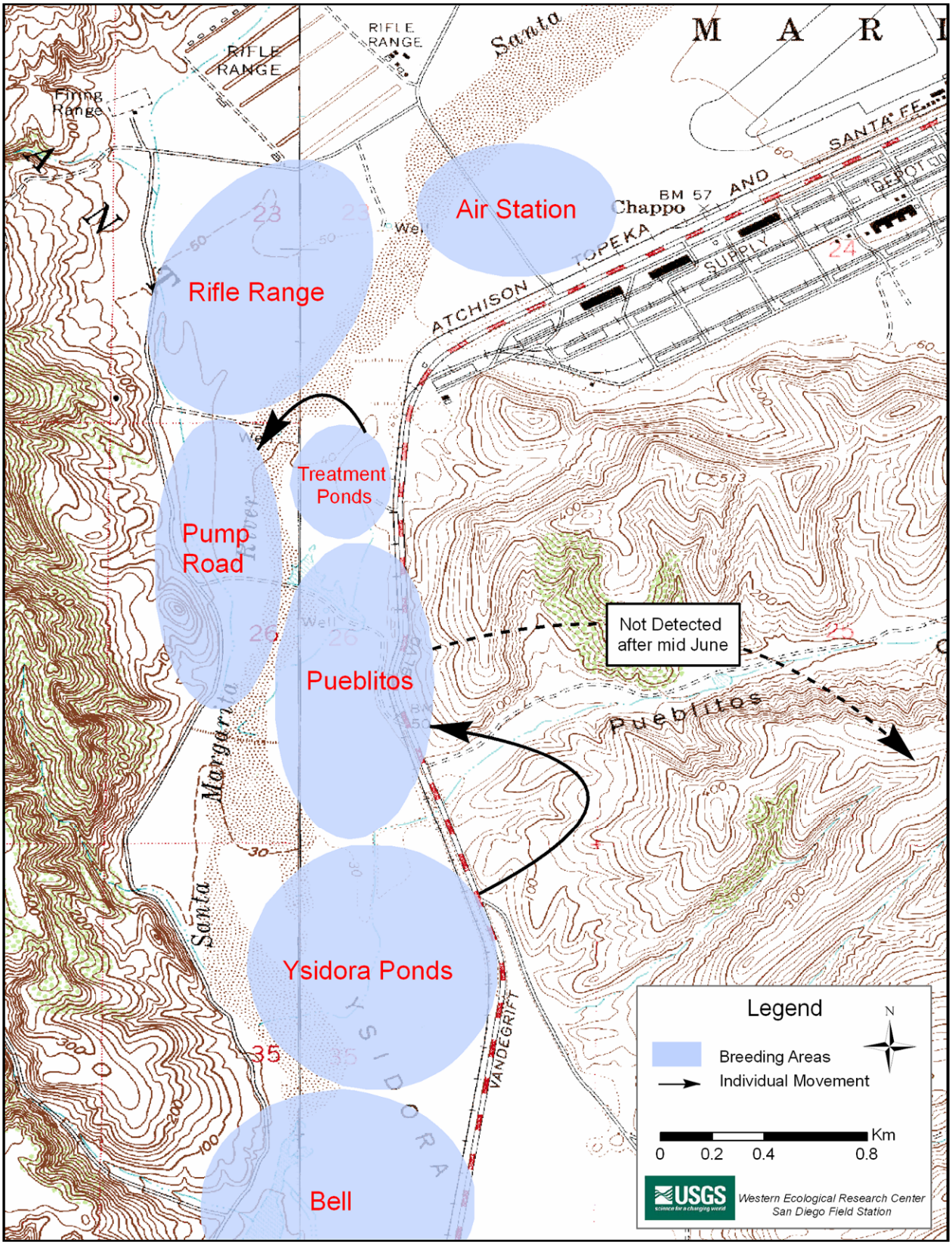

Figure 3. Same-year, between-area movement by southwestern willow flycatchers at Marine Corps Base Camp Pendleton, 2007 at the Santa Margarita River.

DISCUSSION

The 2007 breeding season followed the second winter (October-March) of below average precipitation in San Diego County (8.5 cm in 2007, 9.3 cm in 2006, average annual rainfall = 25 cm), in dramatic contrast to the 2005 season which followed a winter of record-breaking rainfall (55.3 cm; Western Regional Climate Center 2007). The 2005 flooding in San Diego County, which scoured floodplains and widened channels, resulted in dramatic changes to the habitat that were still apparent in 2007. The second consecutive year of below average precipitation continued to hamper the regeneration of perennial riparian vegetation within the affected areas, as well as reduce the vigor of many woody and herbaceous plants within flycatcher breeding sites. Within resident flycatcher territories on Camp Pendleton, herbaceous plants tend to comprise a large proportion of the plant community and in some instances are used as host species for nesting. During the breeding season, many biologists commented that areas within flycatcher territories that in previous years contained herbaceous plants that were at least chest-height grew to only knee height in 2007. The arid conditions on Base were further reflected in the reduction of herbaceous exotic species documented within both resident and transient flycatcher locations. Over the last three years the percent of resident and transient flycatcher locations comprised of at least 50% exotic vegetation has declined from 25% (15/60) in 2005, to 19% (11/57) in 2006, and 5% (4/86) in 2007. While Camp Pendleton does have a Base-wide removal/control program targeting 18 exotic plant species and it is expected that exotic cover should decline over time (MCB Camp Pendleton 2007), it is our thought that the 2007 decline in exotic cover resulted from arid conditions. Also reflecting the increasingly arid conditions on Base, the average distance from flycatcher locations (resident or transient) to the nearest surface water or saturated soil increased from 90 m in 2005 and 168 m in 2006, to 308 m in 2007. A similar trend was documented within resident flycatcher territories with the average distance to the nearest surface water or saturated soil increasing from 68 m in 2005 to 168 m in 2007. The increasing distance from water is not a result of birds moving farther away from river channels or other water sources, as breeding locations have changed little over the passed three years, but has resulted from a contraction in the distribution of surface water on Base.

Overall, the total number of resident willow flycatchers documented on Base in 2007 (26 individuals) was comparable to the 2006 (28) breeding season. However, because of the polygynous nature of flycatchers, where males can mate with up to four females in a season, a more meaningful estimate of flycatcher effective population size is derived from the annual number of breeding females. The number of resident female willow flycatchers detected on Base in 2007 (14) decreased compared to 2006 (19), and was the lowest it has been in six years. At Camp Pendleton, the number of female willow flycatchers has fluctuated between a low of 16 in 2002 and 2003, to a high of 22 in 2004 (Kus and Ferree 2002, Kus and Kenwood 2003, 2005, 2006a, 2006b, Kenwood and Kus 2007). In 2005 and 2006, the total number of females documented on Base was 17 and 19, respectively, with the mean number of female flycatchers averaging 18.0 ± 2.3 (std) per year from 2001 to 2006. The cause of the decrease in the number of females on Base in 2007 is unknown, but may relate to the increasingly arid conditions documented on Camp Pendleton in 2007, possibly causing flycatchers to disperse to nearby off-Base habitat.

Despite the reduction in the number of females documented on Base, the degree of polygyny in the population remained high with 36% (4/11) of paired males polygynous, and 57%

(8/14) of females sharing mates. As in 2005 and 2006, single males were present during the breeding season, but the majority of females chose instead to pair with polygynous birds. This constituted the fifth year in a row where unpaired males were present in the population despite the number of females outnumbering the number of males. Continued monitoring at Camp Pendleton, combined with information from other polygynous populations of willow flycatchers (Davidson and Allison 2003, Pearson *et al.* 2006), should enhance our understanding of the basis for polygyny in this species, and its implications for genetic viability of the population.

The number of transient willow flycatchers detected annually on Base can vary greatly despite consistent survey scope and effort. The number detected in 2007 (70) was double that of 2005 and 2006 (Kus and Kenwood 2006b, 2007), comparable to the 2004 total (82; Kus and Kenwood 2006a), and almost double the number documented in 2003 (39; Kus and Kenwood 2005). Presumably the majority of the transient/migrating birds are of a different sub-species of willow flycatcher, most likely *E. t. brewsteri* or possibly *E. t. adastus*, and not the southwestern sub-species (*E. t. extimus*) that breeds on Base. Variation in the annual number of transients therefore is most likely a result of anthropogenic or ecological factors that are possibly different from those influencing *E. t. extimus* distribution and abundance.

As in previous years, resident flycatchers were largely distributed among historic breeding locations, although the number of territories each location supported varied compared to prior years. The four core flycatcher breeding sites on the Santa Margarita River (Treatment Ponds, Ysidora Ponds, Pueblitos, and Pump Road) were all re-colonized to varying degrees in 2007. Three of the sites decreased in flycatcher numbers, while one increased. The number of breeding pairs/females decreased at Treatment Ponds (-2), Ysidora Ponds (-2), and Pueblitos (-5), and increased by a single territory at Pump Road in 2007. Outside of these four sites, two flycatcher pairs re-colonized the Air Station site, which had been devoid of birds since 2005 (Kus and Kenwood 2006b), and two pairs were confirmed breeding within a new area of the Rifle Range site, just north on the Pump Road site. The only flycatcher territory documented outside of the core matrix of flycatcher breeding locations on the Santa Margarita River was a single pair of birds that attempted to nest on lower San Mateo Creek. These birds disappeared after their first nest attempt failed in mid-June.

Because of their semi-colonial nature, flycatchers within each of these locations can be expected to interact frequently. However, the proximity of the sites on the Santa Margarita River is such that movement between locations occurs annually, as well as within breeding seasons. In 2007, three adult flycatchers were documented nesting in areas that were different from their last documented breeding location. In 2005 and 2006, seven adult flycatchers (per year) were documented dispersing to different breeding locations. It is possible that habitat conditions are the dominant reason for birds to disperse between breeding sites, as there has been no correlation between productivity and/or nest success at the original breeding location and the likelihood that a flycatcher will disperse to a new location the following year (USGS Western Ecological Research Center, San Diego Field Station unpubl. data). In 2007, the three adult flycatchers that dispersed from their 2006 breeding locations all moved into the Pump Road or adjacent Rifle Range sites. Because of a cracked irrigation pipe that began flooding habitat in 2005 and was not repaired until August 2007, these sites contained standing water throughout most of the breeding season, and were the wettest breeding locations documented in 2007. It is reasonable to assume that flycatchers may be attempting to maximize their fitness by annually evaluating all

habitat within the matrix of breeding sites on the Santa Margarita River and selecting what is judged to be the highest quality habitat.

The increasingly arid conditions on Base may be an important factor affecting flycatcher reproductive success, as reduced precipitation has been negatively correlated with flycatcher nest success in Arizona (Paxton *et al*. 2007), as well as avian productivity of other passerine species (Rotenberry and Wiens 1989, 1991, Li and Brown 1999). Overall nest success and productivity decreased in 2007 compared to 2005 and 2006 estimates. Forty-two percent (8/19) of nests fledged young in 2007 compared to 52% (13/25) in 2006, and 60% (15/25) in 2005. Average productivity per pair decreased from 1.8 and 1.7 young per pair in 2006 and 2005, respectively, to 1.4 young per pair in 2007. The reduction in overall productivity did not stem from a decrease in clutch size, although clutch size was lower in 2007 (2.7 eggs per nest), compared to 2006 and 2005 (3.1 and 3.2 eggs per nest, respectively), but was rather a result of an increase in the number of eggs that did not hatch (n = 4). Three of the four nests containing infertile eggs eventually fledged young. Of the 25 eggs laid in successful nests in 2007, these four losses represent a 16% reduction in the potential number of young that could have been produced had they hatched/survived. Overall, 12% (4/33) of all eggs failed to hatch in 2007, compared to 8% (6/73) in 2005 and 2% (1/63) in 2006.

The return rate of banded adults between 2006 and 2007 (36-64%) was comparable to that observed over the previous two years (31% in 2005, 52% in 2006). Return of second year birds was slightly lower (11%, 3/27) than in recent years, as 11% (3/27) of nestlings that survived to fledge in 2006 returned to breed in 2007, compared to 15% in 2004 (5/34) and 2006 (4/26) and 17% (7/42) in 2005. Although the rate of return of second year birds seems low, the total percentage of adults within the breeding population that were banded as nestlings tends to increase annually. In 2007, almost one third (31%, 8/26) of the total adult flycatcher population on Base were originally banded as nestlings. The presence of such a large percentage of natal banded birds creates the opportunity to collect life-time reproductive data for a growing segment of the population, which will facilitate identification of age- and sex-specific patterns in life history characteristics that influence population size, productivity, and genetic structure.

Six cases of immigration into the Camp Pendleton population from the San Luis Rey River (9-24 km distant) have been documented since 2002 (Kus and Kenwood 2003, 2005, 2006a, 2006b, Kenwood and Kus 2007). Although no immigration or emigration from Camp Pendleton by flycatchers was documented in 2007, the occurrence of past movement between the drainages is an encouraging sign that regional flycatcher populations are connected through dispersal over a large area. Further banding and resighting of flycatchers throughout their range will allow a better determination of the extent of movement between populations and the role such movement plays in maintaining genetic diversity and persistence in these populations.

LITERATURE CITED

Davidson, R.F. and L.J. Allison. 2003. Effects of monogamy and polygyny on reproductive success in southwestern willow flycatchers (*Empidonax traillii extimus*) in Arizona. Studies in Avian Biology 26: 118-124.

Gaines, D. 1988. Birds of Yosemite and the east slope. Artemesia Press, Lee Vining, California.

Garrett, K. and J. Dunn. 1981. Birds of southern California: status and distribution. The Artisan Press, Los Angeles.

Grinnell, J. and A. Miller. 1944. The distribution of the birds of California. Pac. Coast Avif. 27.

Howell, S.L., M.J. Wellik, and B.E. Kus. 2007. Neotropical migratory bird monitoring study at Marine Corps Base Camp Pendleton, California. 2006 Annual Data Summary. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Howell, S.L., M.J. Wellik, and B.E. Kus. 2008. Neotropical migratory bird monitoring study at Marine Corps Base Camp Pendleton, California. 2007 Annual Data Summary. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Hubbard, J.P. 1987. The status of the willow flycatcher in New Mexico. Endangered Species Program, New Mexico Dept. of Game and Fish, Santa Fe, NM.

Kenwood, K.E. and B.E. Kus. 2007. Distribution, abundance and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2006 Annual Data Summary. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E. 2001. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California, in 2000. Final Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E., P.P. Beck, and J.M. Wells. 2003. Southwestern willow flycatcher populations in California: Distribution, abundance, and potential for conservation. Studies in Avian Biology 26: 12-21.

Kus, B.E. and K. Ferree. 2002. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2001 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E. and K. Kenwood. 2003. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2002 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E. and K. Kenwood. 2005. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2003 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E. and K. Kenwood. 2006a. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2004 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B.E. and K. Kenwood. 2006b. Distribution, abundance, and breeding activities of the southwestern willow flycatcher at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for the Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

Kus, B. E. and M.J. Whitfield. 2005. Parasitism, productivity, and population growth: response of least Bell's vireos (*Vireo bellii pusillus*) and southwestern willow flycatchers (*Empidonax traillii extimus*) to cowbird (*Molothrus* spp.) control. Ornithological Monographs 57:16-27.

Li, S.H. and J.L. Brown. 1999. Influence of climate on reproductive success in Mexican Jays. Auk 116:924-936.

MCB Camp Pendleton. 2007. Marine Corps Integrated Natural Resources Management Plan. U.S. Marine Corps Base, Camp Pendleton, California.

Paxton, E.H., M.K. Sogge, S.L. Durst, T.C. Theimer, and J.R. Hatten. 2007. The ecology of the southwestern willow flycatcher in central Arizona – a 10-year synthesis report. U.S. Geological Survey Open-File Report 2007-1381, 143p.

Pearson, T., M.J. Whitfield, T.C. Theimer, and P. Keim. 2006. Polygyny and extra-pair paternity in a population of southwestern willow flycatchers. Condor 108:571-578.

Peterson, B.L., B.E. Kus, and D.H. Deutschman. 2004. Determining nest predators of the least Bell's vireo through point counts, tracking stations, and video photography. Journal of Field Ornithology 75:89-95.

Remson, J.V., Jr. 1978. Bird species of special concern in California. California Department of Fish and Game, Wildlife Management Division, Administrative Report 78-1.

Rotenberry, J.T. and J.A. Wiens. 1989. Reproductive biology of shrubsteppe passerine birds: Geographical and temporal variation in clutch size, brood size and fledging success. Condor 91:1-14.

Rotenberry, J.T. and J.A. Wiens. 1991. Weather and reproductive in shrubsteppe sparrows: a hierarchal analysis. Ecology 72:1325-1335.

Rourke, J.W., T.D. McCarthey, R.F. Davidson, and A.M. Santaniello. 1999. Southwestern willow flycatcher nest monitoring protocol. Nongame and Endangered Wildlife Program Technical Report 144. Arizona Game and Fish Department, Phoenix, Arizona.

Schlorff, R.W. 1990. Status review of the willow flycatcher (*Empidonax traillii*) in California. Report to the Fish and Game Commission, State of California Resources Agency.

Schuetz, J.G. and M.J. Whitfield. 2007. Southwestern willow flycatcher monitoring and removal of brown-headed cowbirds on the south fork Kern River in 2006. Draft report (Contract W91238-04-0014). Prepared for the U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Sogge, M.K., R.M. Marshall, S.J. Sferra, and T.J. Tibbitts. 1997. A southwestern willow flycatcher natural history summary and survey protocol. National Park Service/USGS Colorado Plateau Research Station, Northern Arizona University. NRTR-97/12.

Unitt, P. 1984. The birds of San Diego County. San Diego Society of Natural History.

Unitt, P. 1987. *Empidonax traillii extimus*: an endangered subspecies. Western Birds 18:137-162.

U.S. Fish and Wildlife Service. 1993. Proposal to list the southwestern willow flycatcher as an endangered species and to designate critical habitat. Federal Register 58:39495-39522.

Varanus Biological Services. 2001. Southwestern Willow Flycatcher field season 2000 data summary. Prepared for the U.S. Bureau of Reclamation, Phoenix Office.

Western Regional Climate Center. 2007. San Diego WSO Airport, California Monthly Total Precipitation. http://wrcc.dri.edu/.

Wheelock, I.G. 1912. Birds of California: an introduction to more than three hundred common birds of the state and adjacent islands. A.C. McClurg and Company, Chicago, Illinois.

Whitfield, M.J. and M.K. Sogge. 1999. Range-wide impact of brown-headed cowbird parasitism on the southwestern willow flycatcher (*Empidonax traillii extimus*). Studies in Avian Biology 18:182-190.

Willett, G. 1912. Birds of the Pacific slope of southern California. Pacific Coast Avifauna 7.

Willett, G. 1933. A revised list of the birds of southwestern California. Pacific Coast Avifauna 21.

APPENDIX A

SOUTHWESTERN WILLOW FLYCATCHER SURVEY AREAS AT MARINE CORPS BASE CAMP PENDLETON, 2007

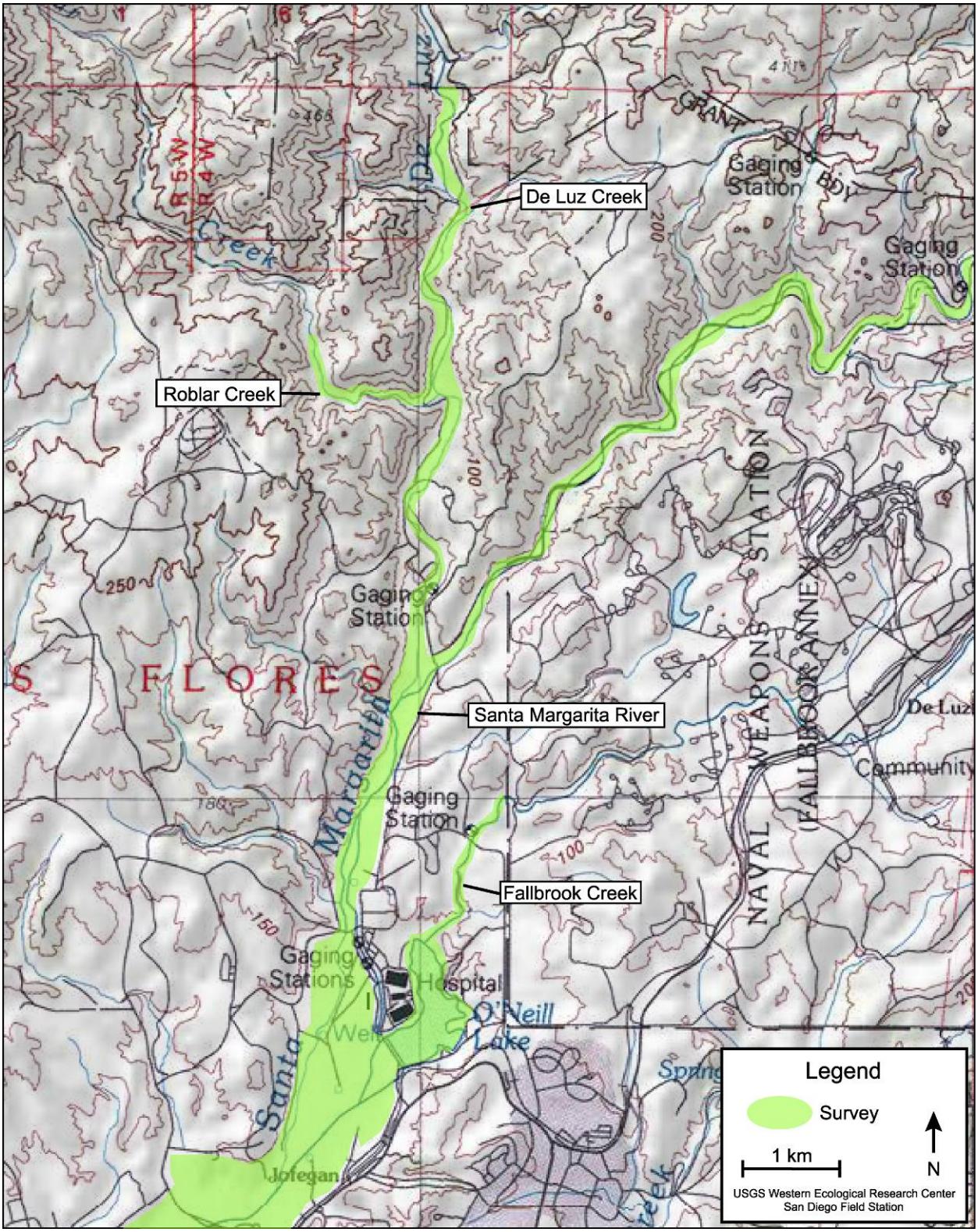

Figure 4. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: Santa Margarita River, Fallbrook Creek, De Luz Creek and Roblar Creek.

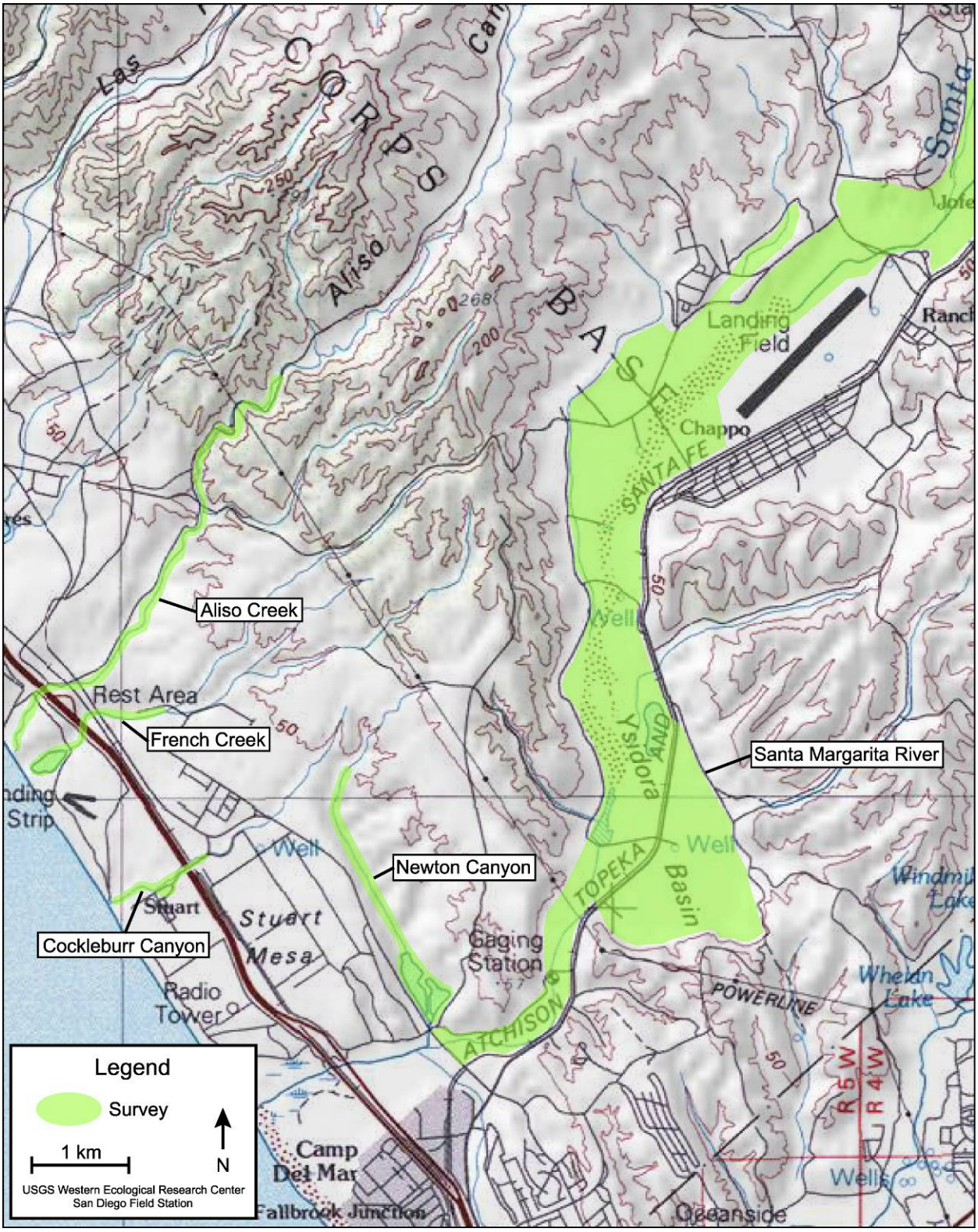

Figure 5. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: Santa Margarita River, Newton Canyon, Cockleburr Canyon, French Creek, and Aliso Creek.

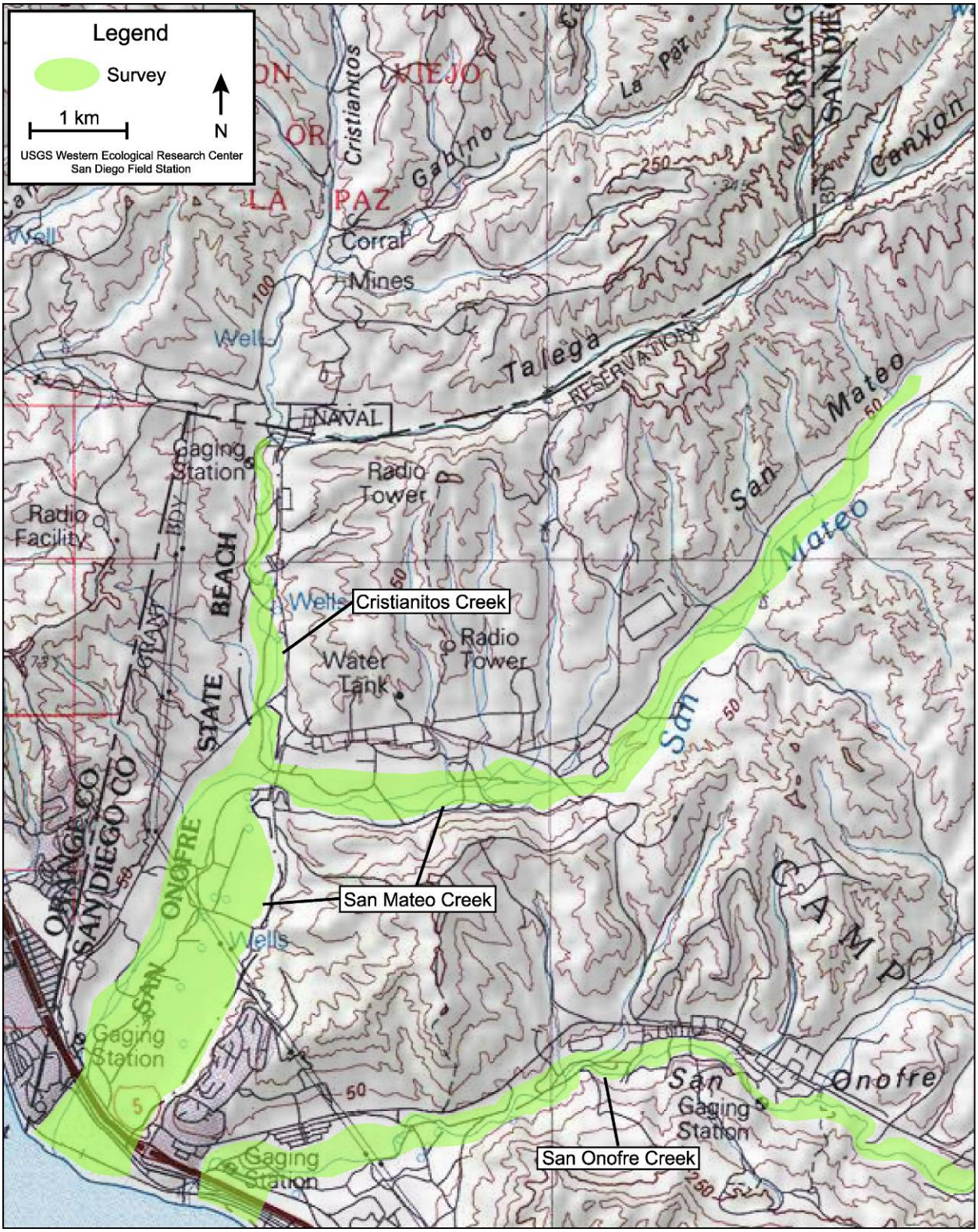

Figure 6. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: Cristianitos Creek, San Mateo Creek and San Onofre Creek.

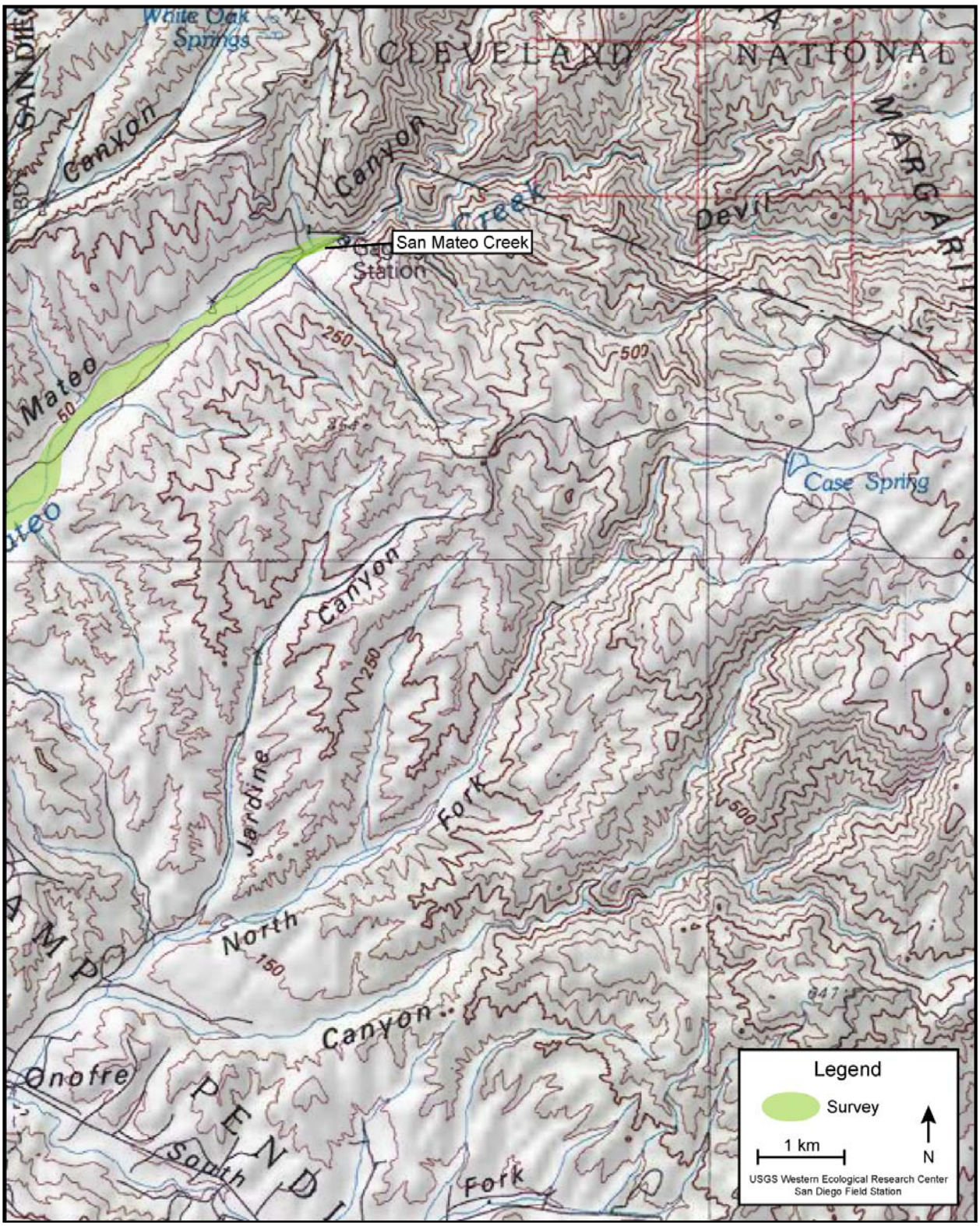

Figure 7. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: San Mateo Creek.

Figure 8. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: Las Flores Creek, Piedra de Lumbre Canyon, Horno Canyon, and San Onofre Creek.

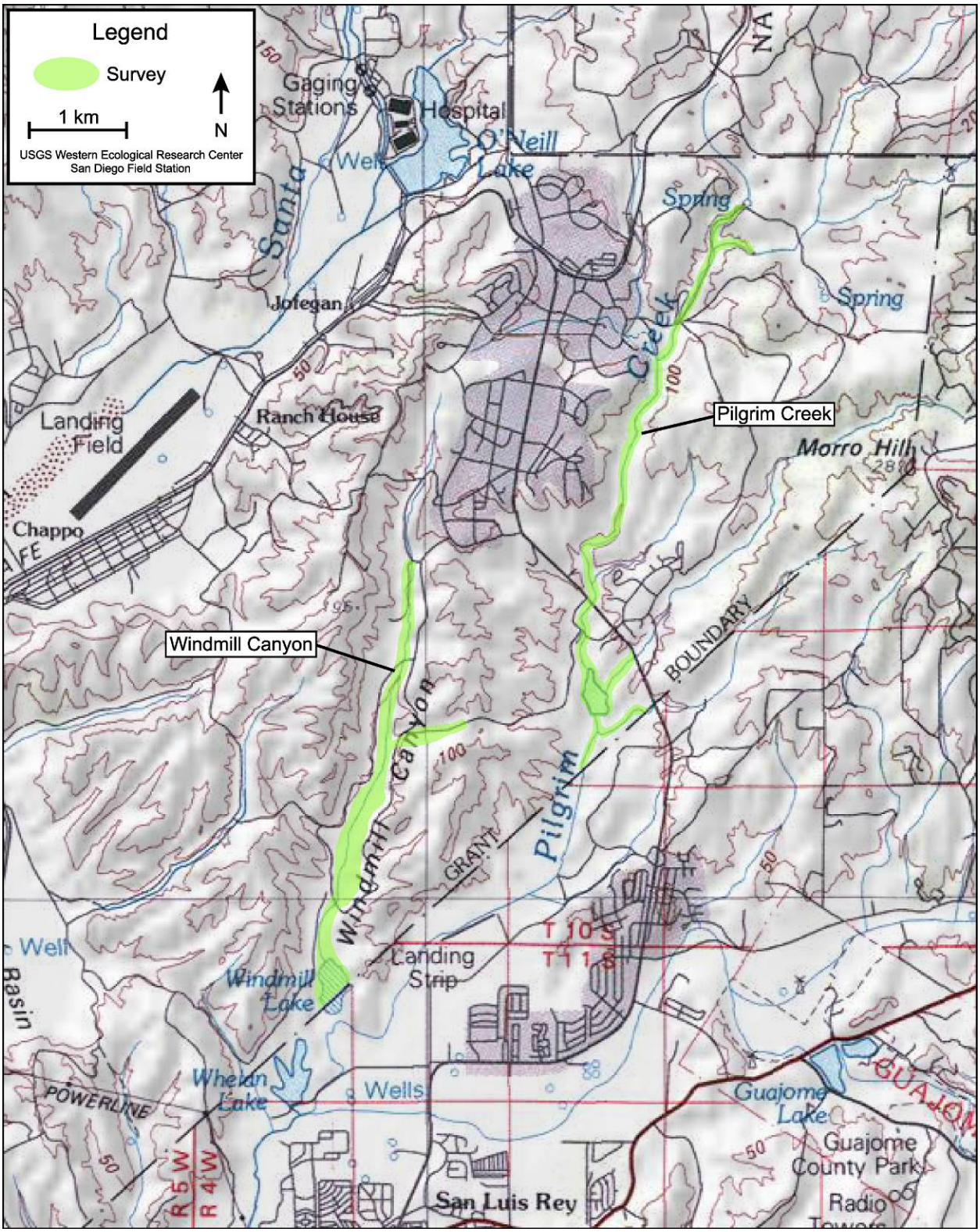

Figure 9. Willow flycatcher survey areas at Marine Corps Base Camp Pendleton, 2007: Windmill Canyon and Pilgrim Creek.

APPENDIX B

LOCATIONS OF SOUTHWESTERN WILLOW FLYCATCHER AT MARINE CORPS BASE CAMP PENDLETON, 2007

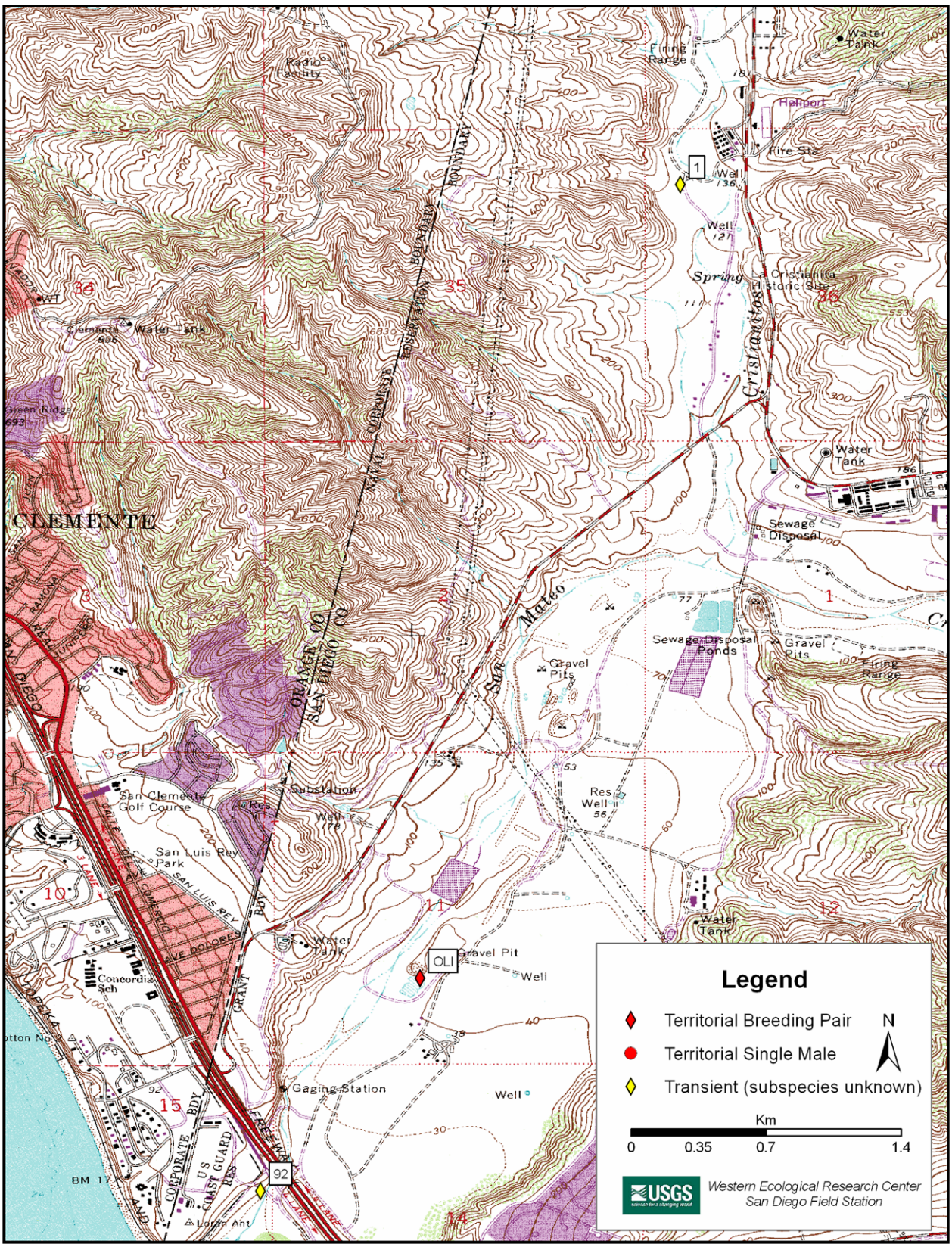

Figure 10. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Cristianitos Creek and San Mateo Creek.

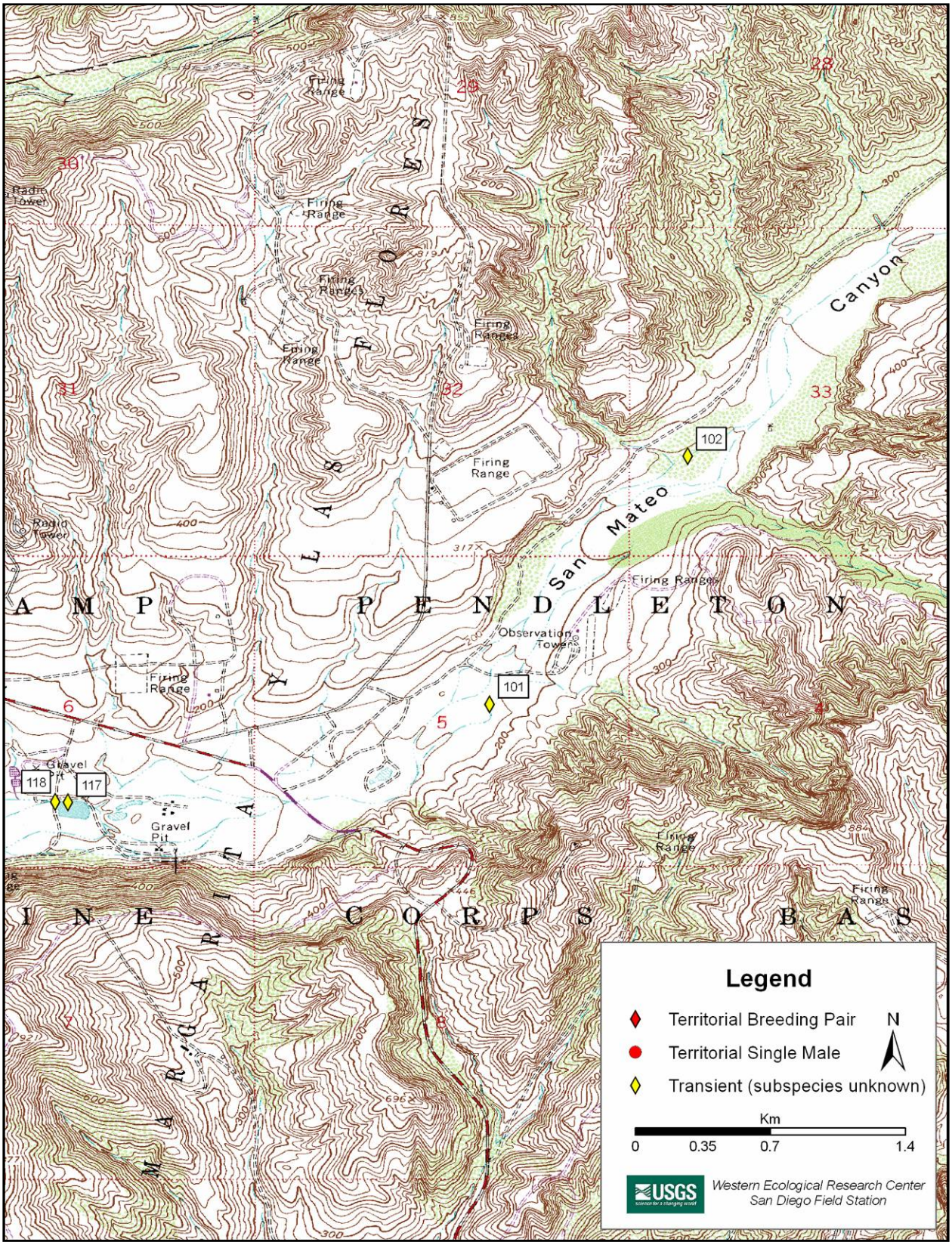

Figure 11. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: San Mateo Creek (upstream).

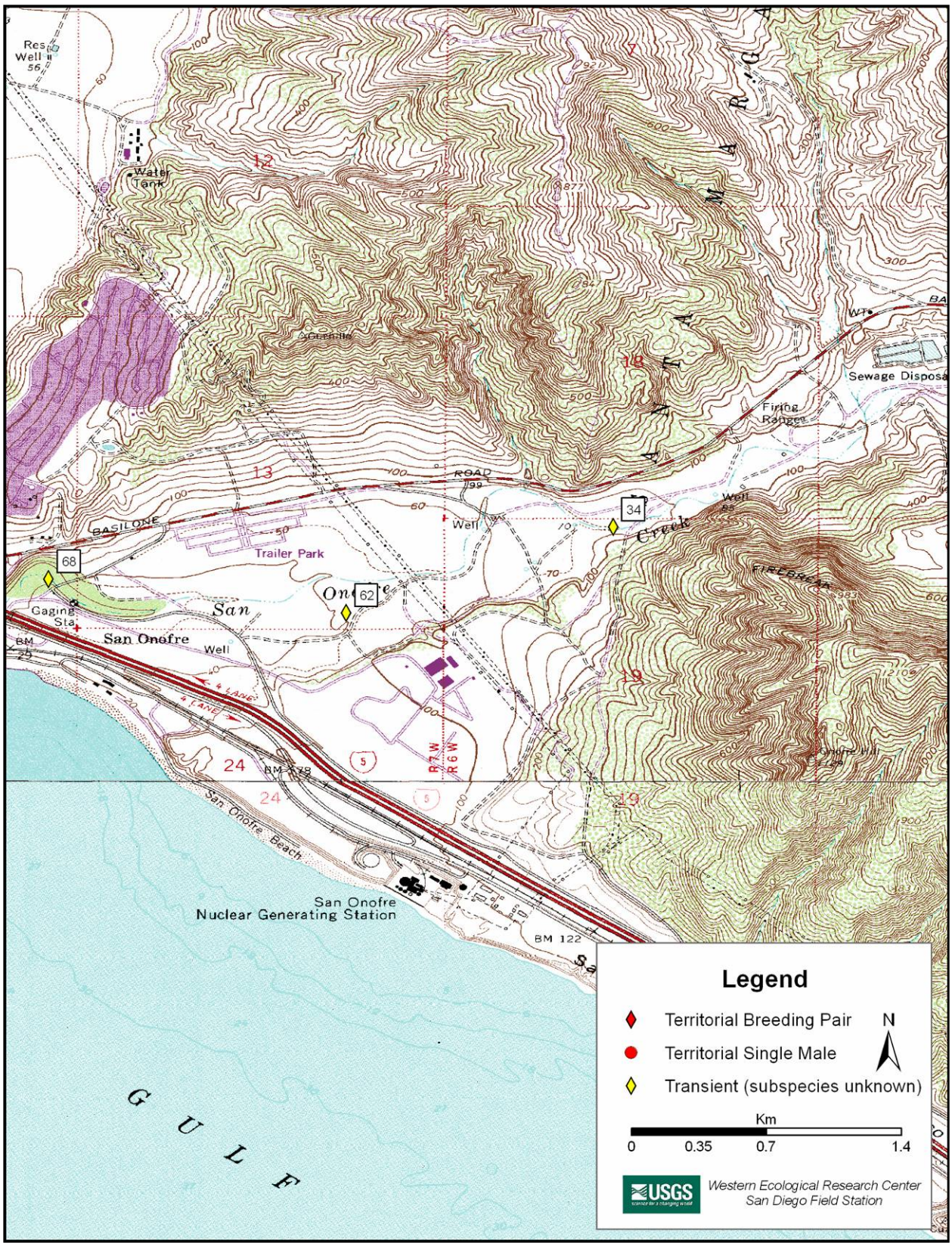

Figure 12. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: San Onofre Creek (downstream).

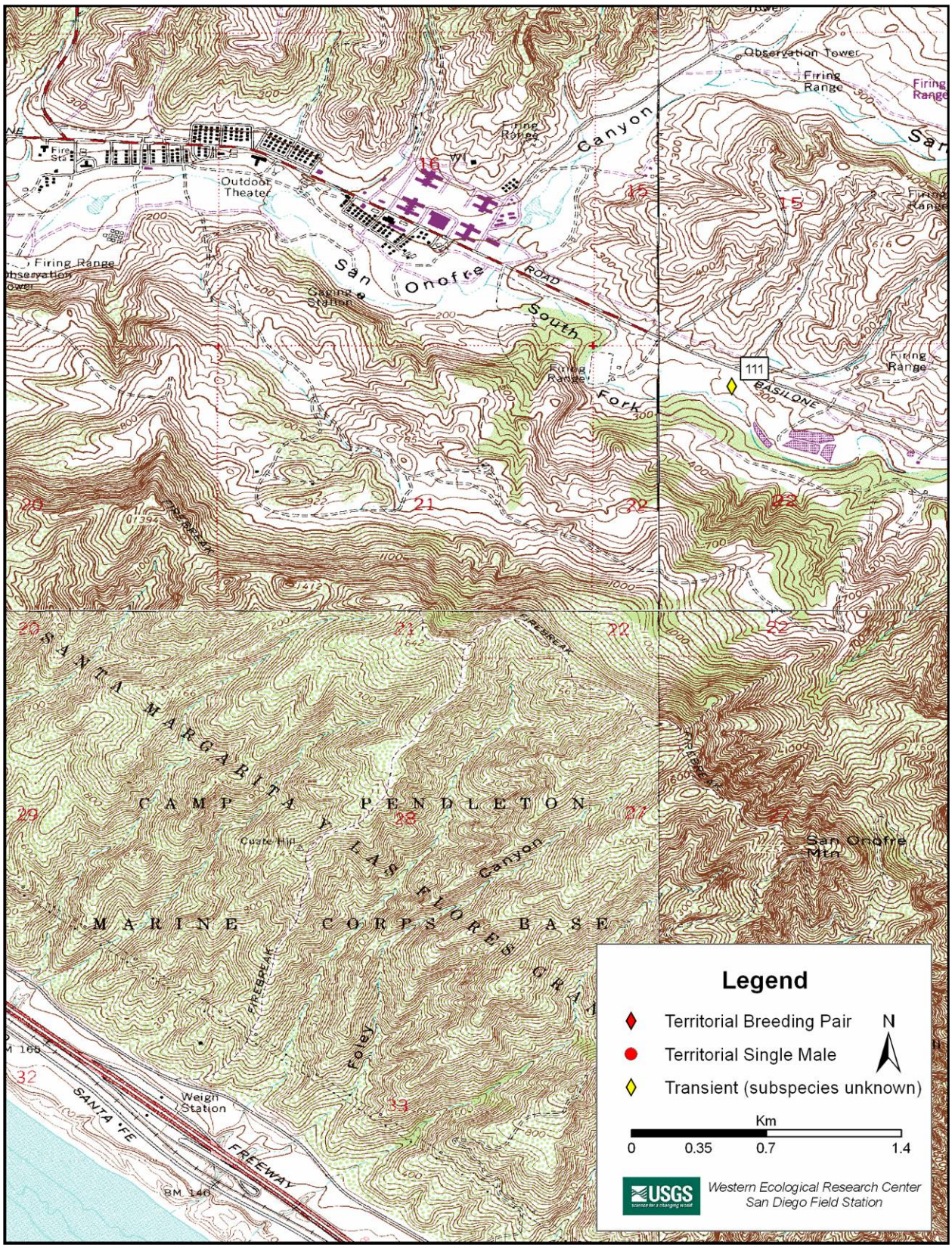

Figure 13. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: San Onofre Creek (upstream).

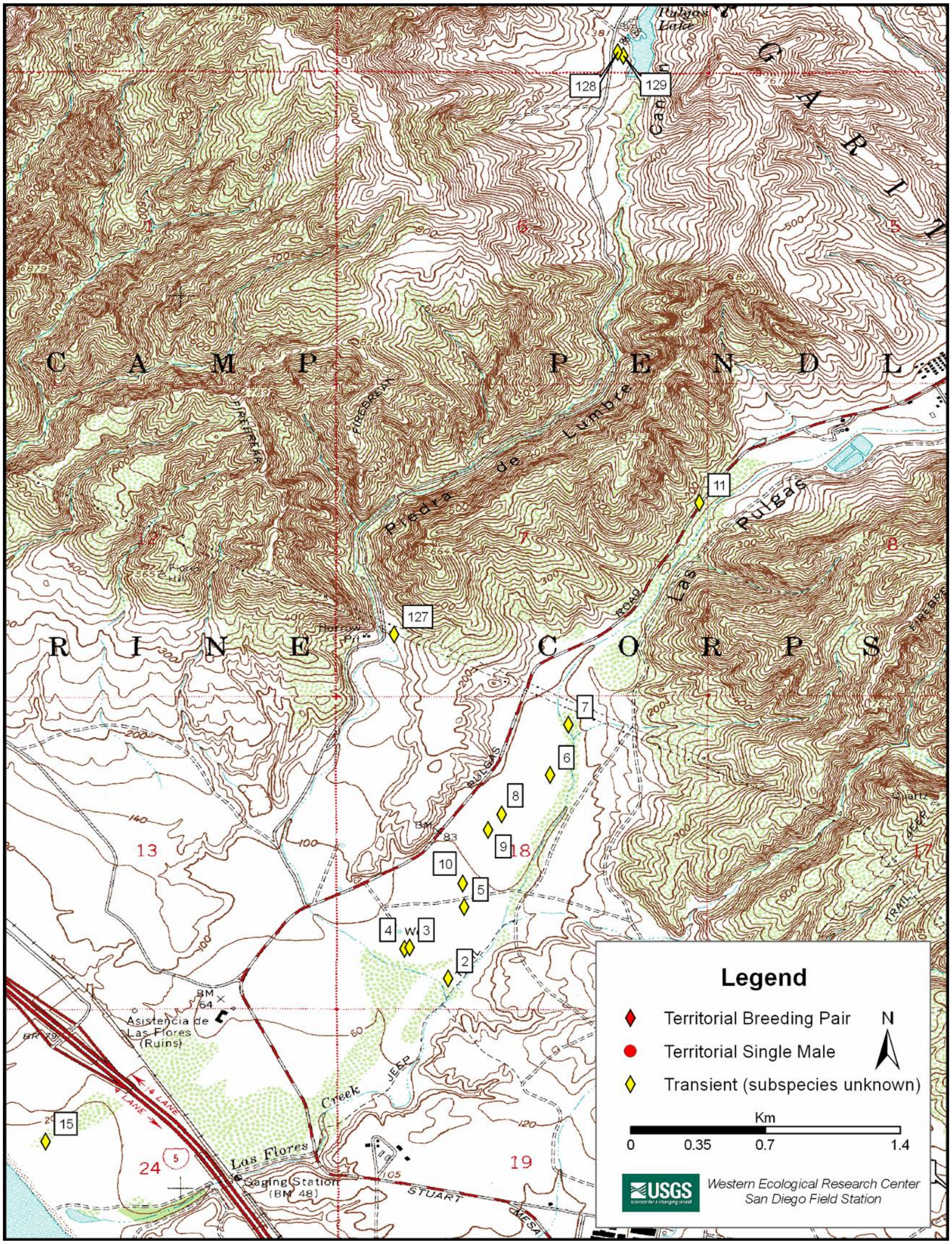

Figure 14. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Las Flores Creek (downstream) and Piedra de Lumbre Canyon.

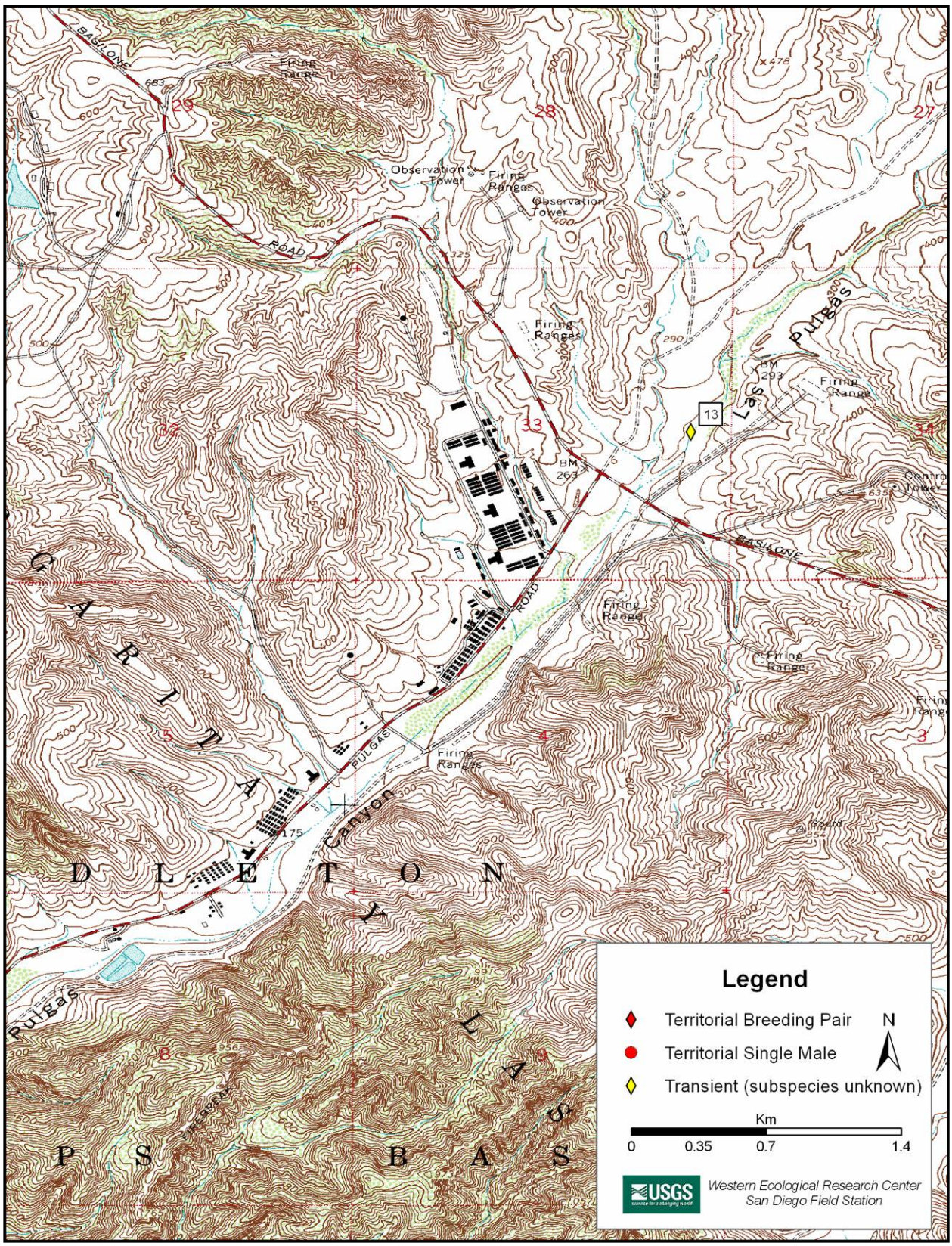

Figure 15. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Las Flores Creek (upstream).

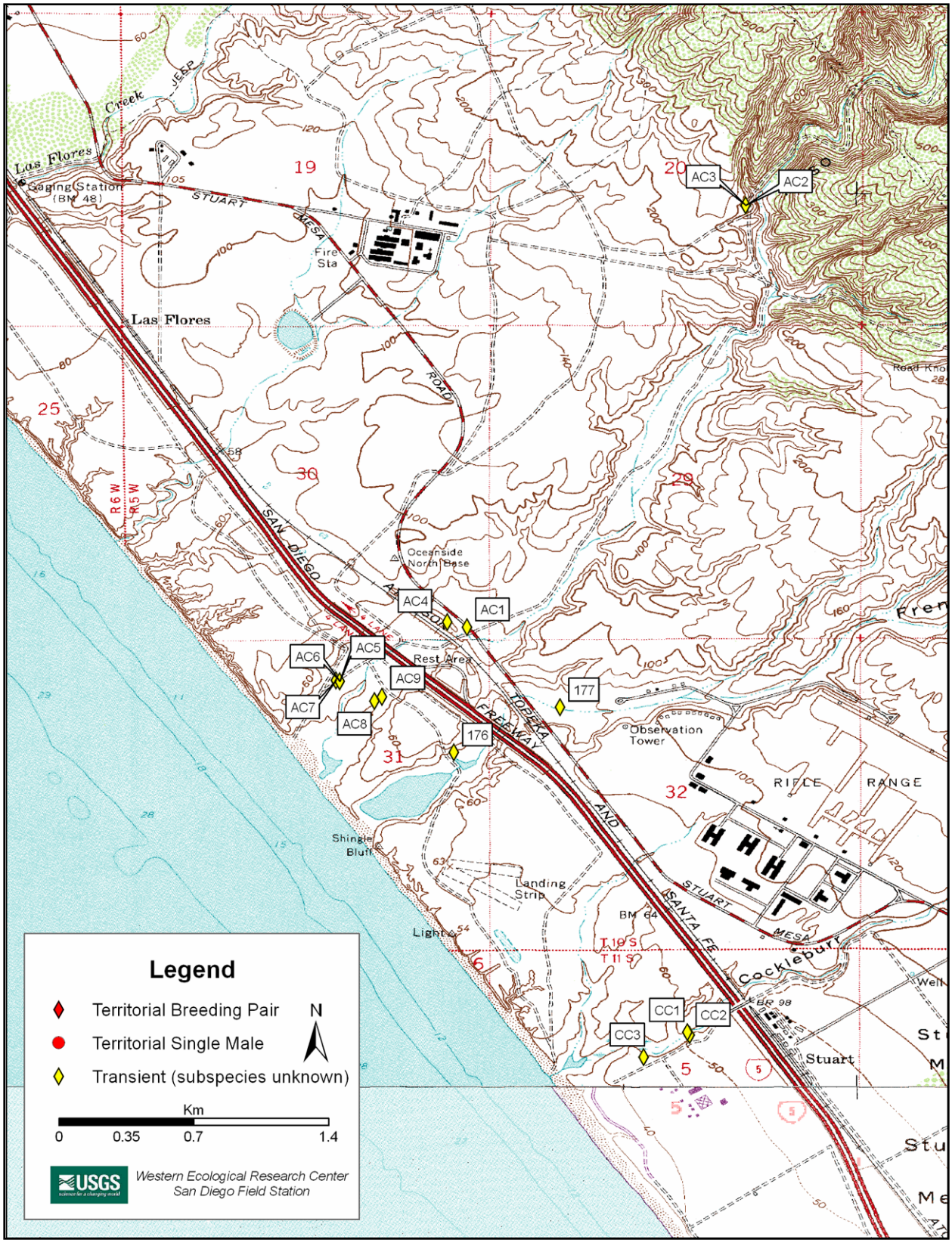

Figure 16. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Aliso Creek, French Creek, and Cockleburr Canyon.

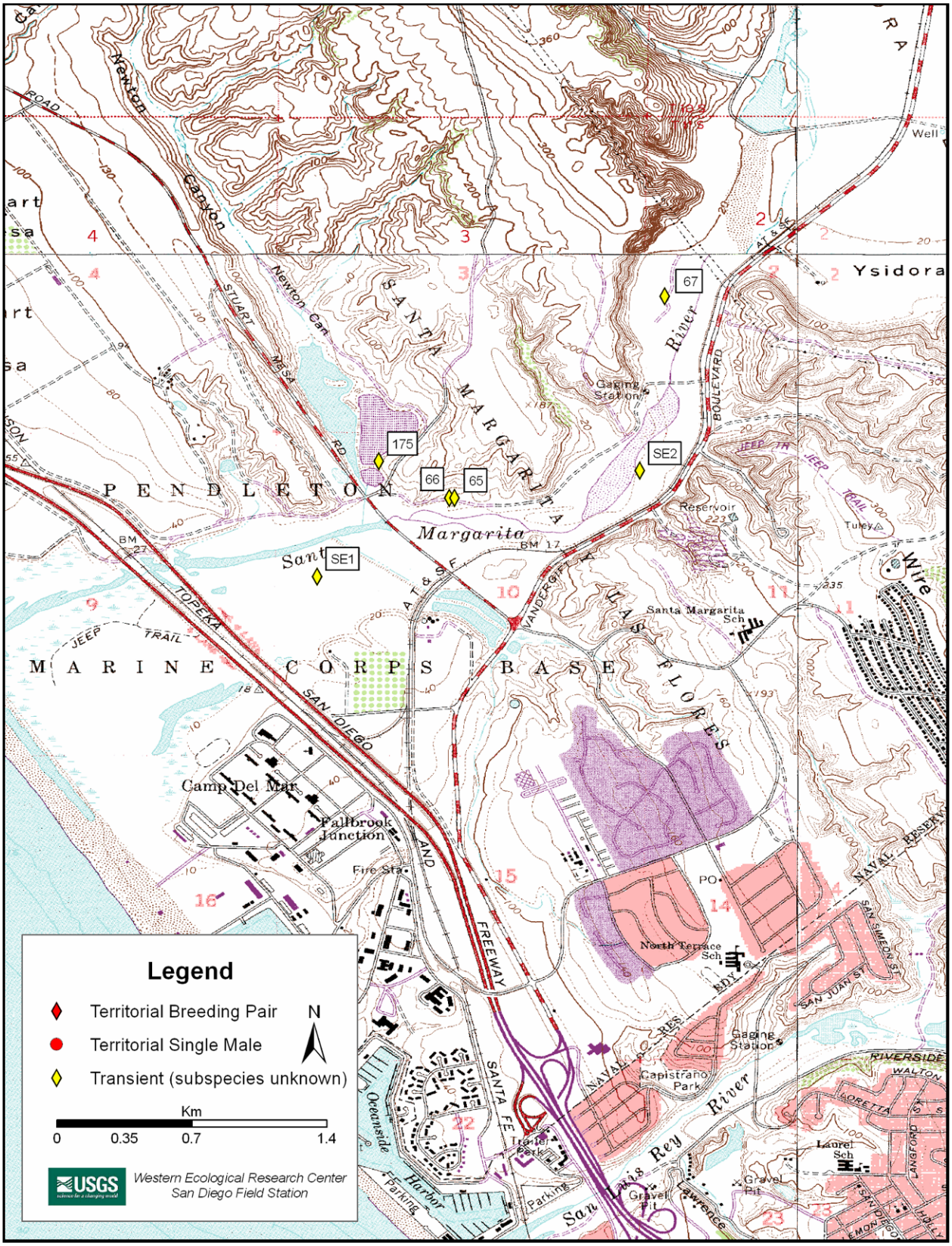

Figure 17. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Newton Canyon and Santa Margarita River (downstream).

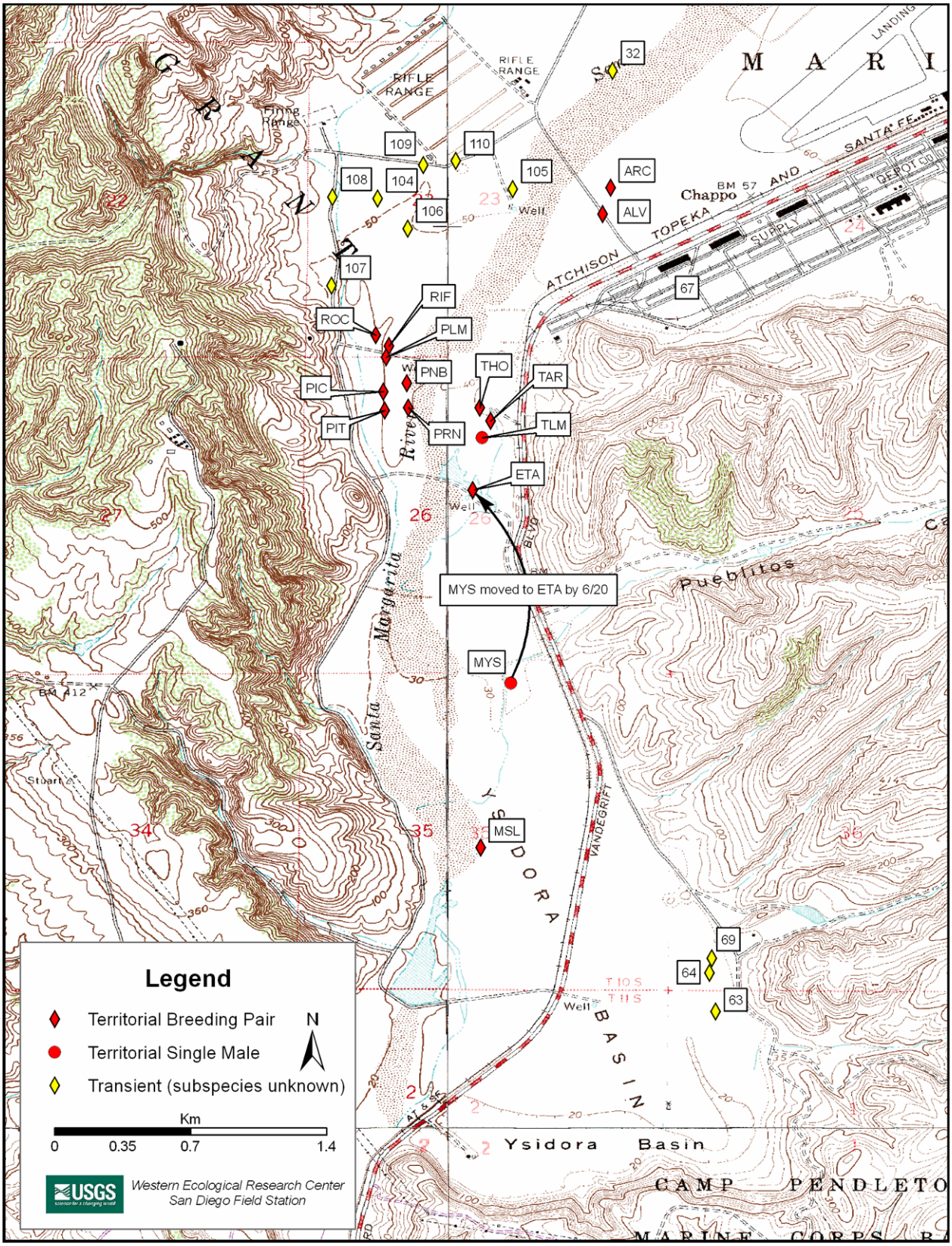

Figure 18. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Santa Margarita River.

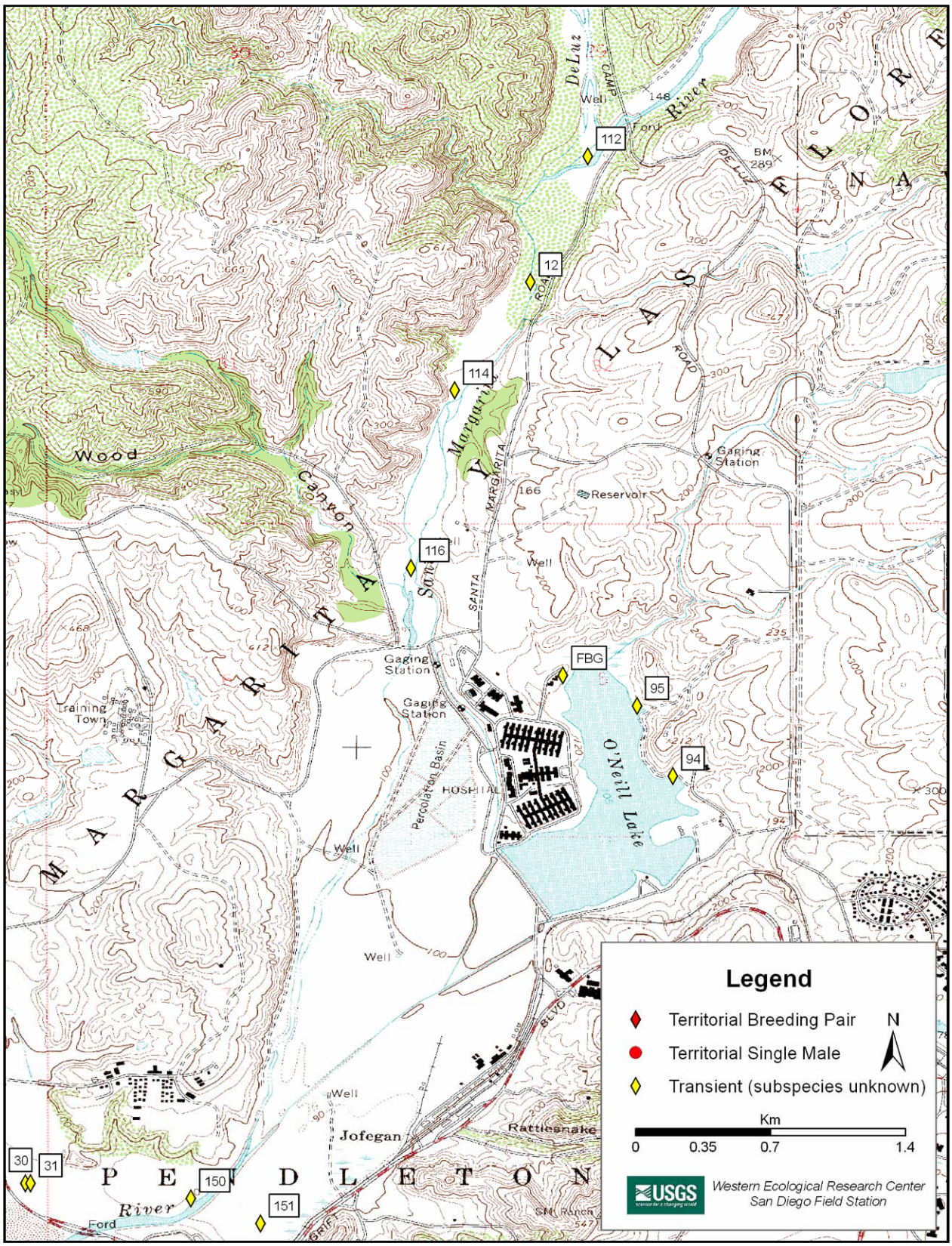

Figure 19. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Santa Margarita River and Fallbrook Creek.

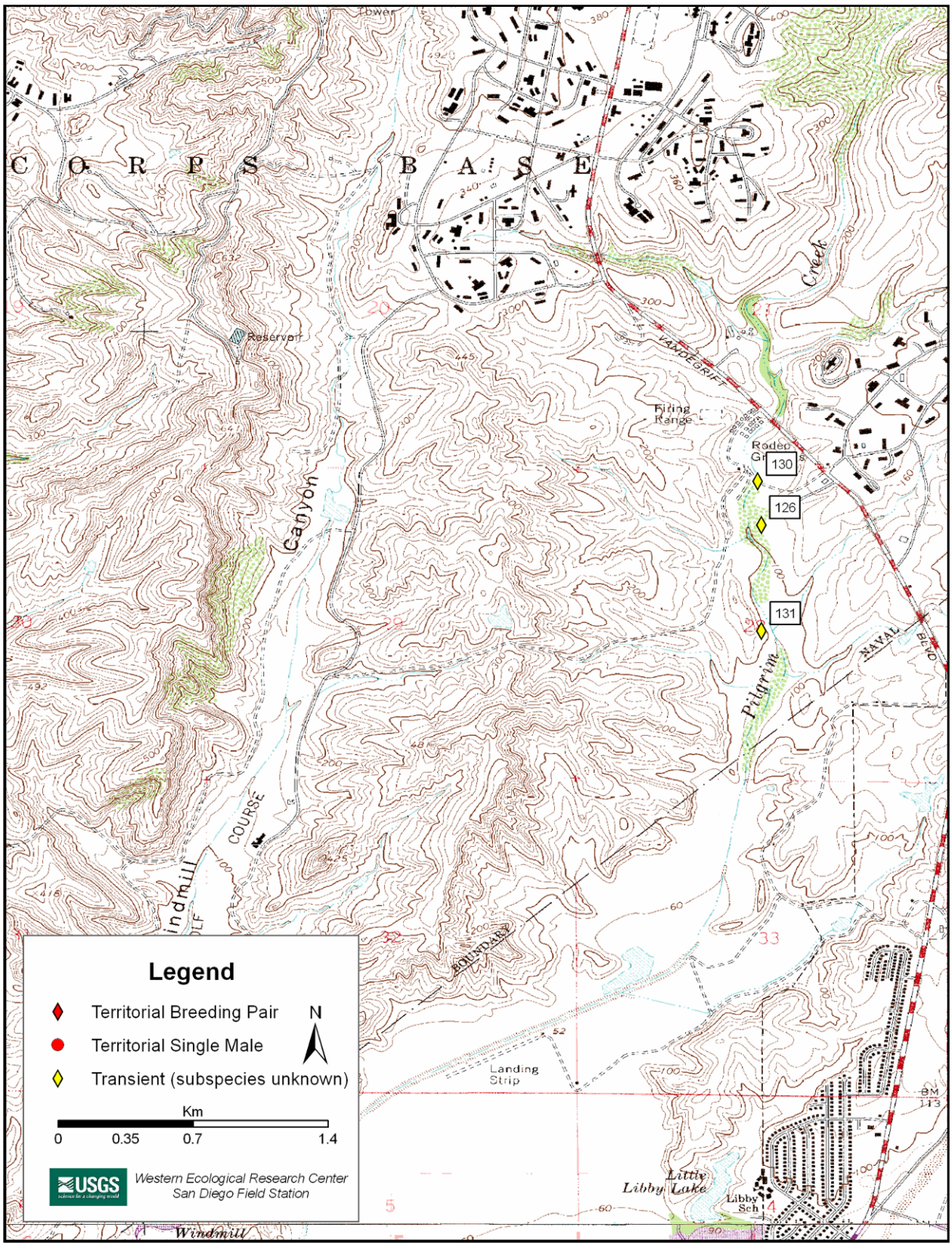

Figure 20. Locations of willow flycatchers at Marine Corps Base Camp Pendleton, 2007: Pilgrim Creek.

APPENDIX C

SOUTHWESTERN WILLOW FLYCATCHER BREEDING LOCATIONS AT MARINE CORPS BASE CAMP PENDLETON, 2007

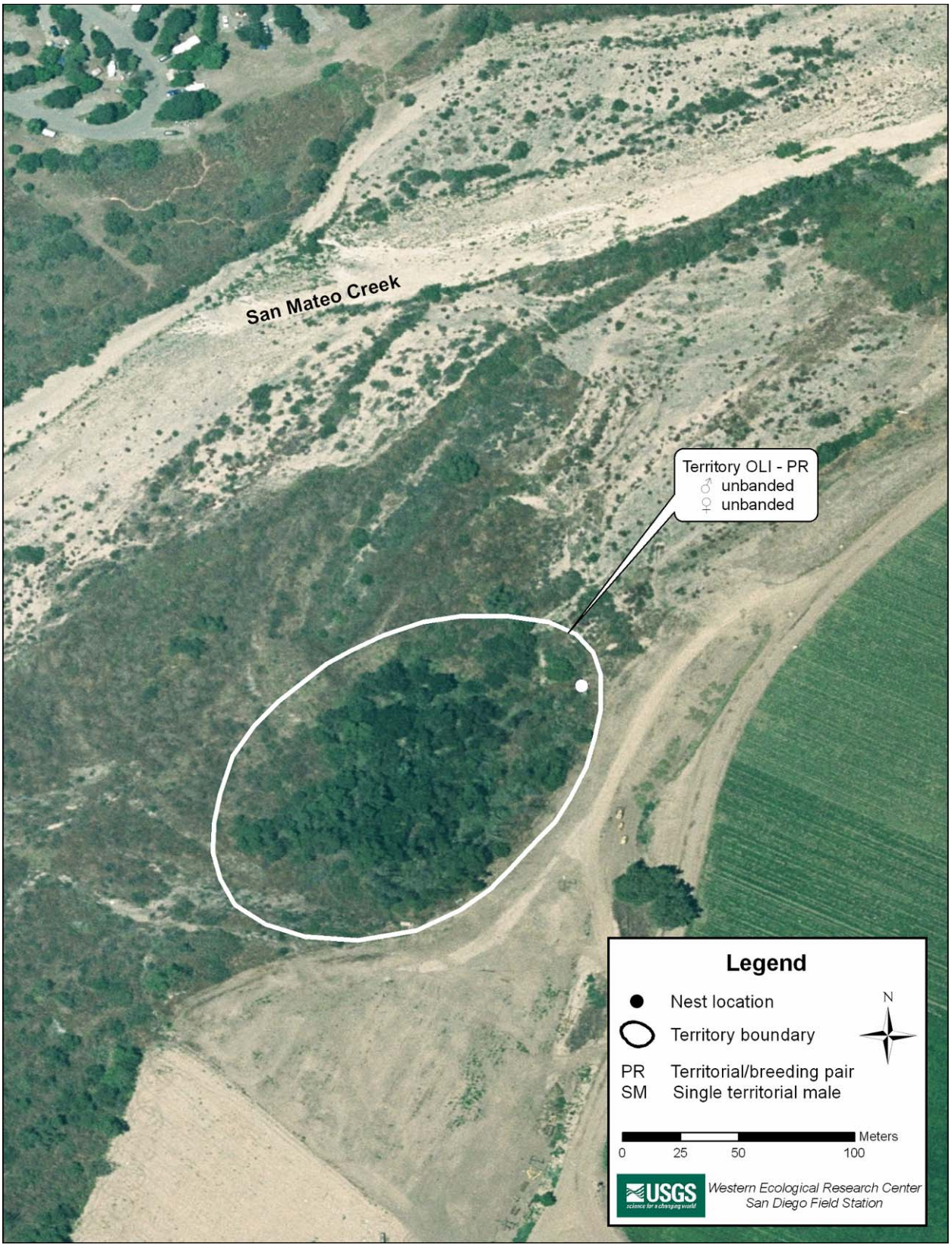

Figure 21. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: San Mateo Breeding Area, San Mateo Creek.

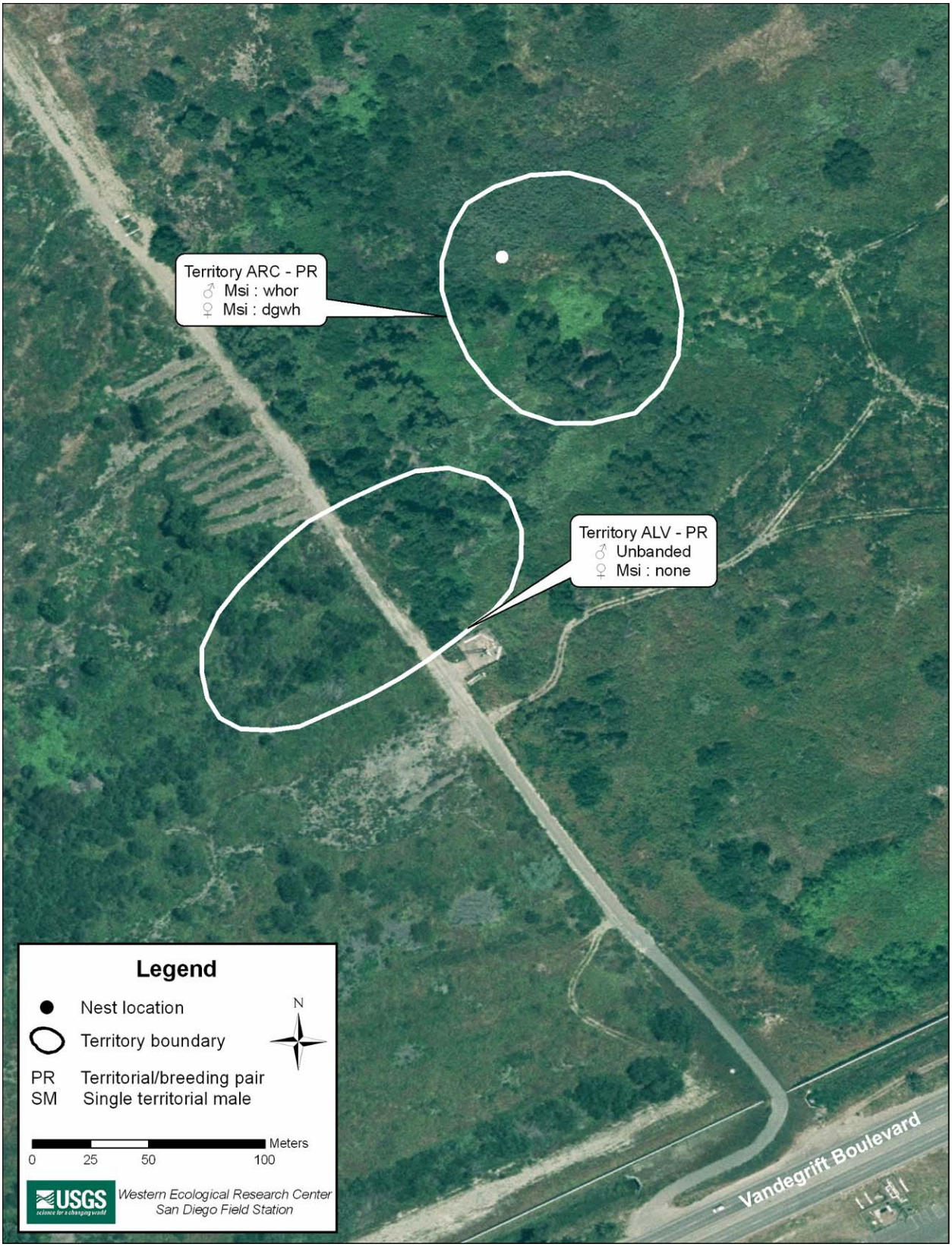

Figure 22. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Air Station Breeding Area, Santa Margarita River.

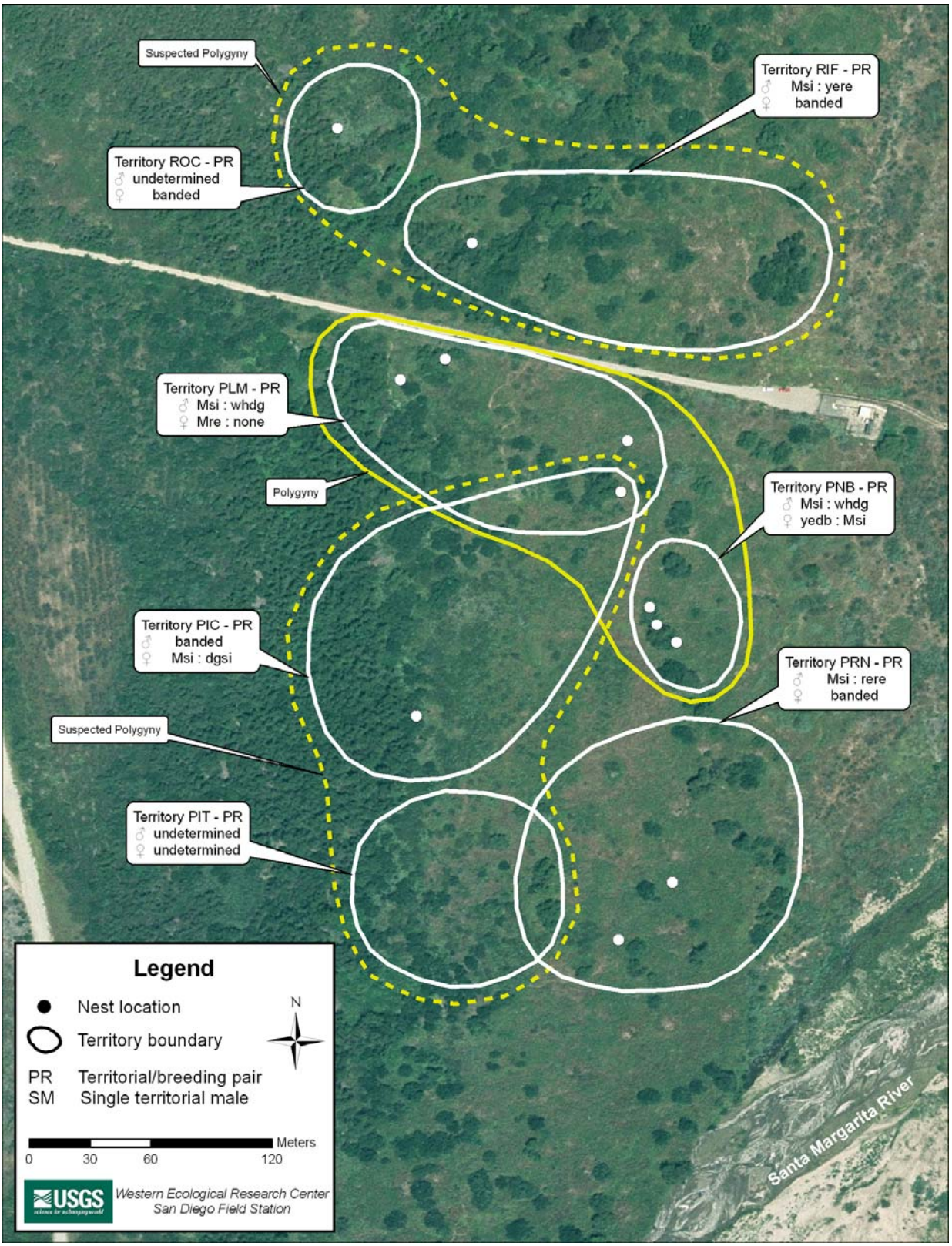

Figure 23. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Rifle Range (north of road) and Pump Road Breeding Areas, Santa Margarita River.

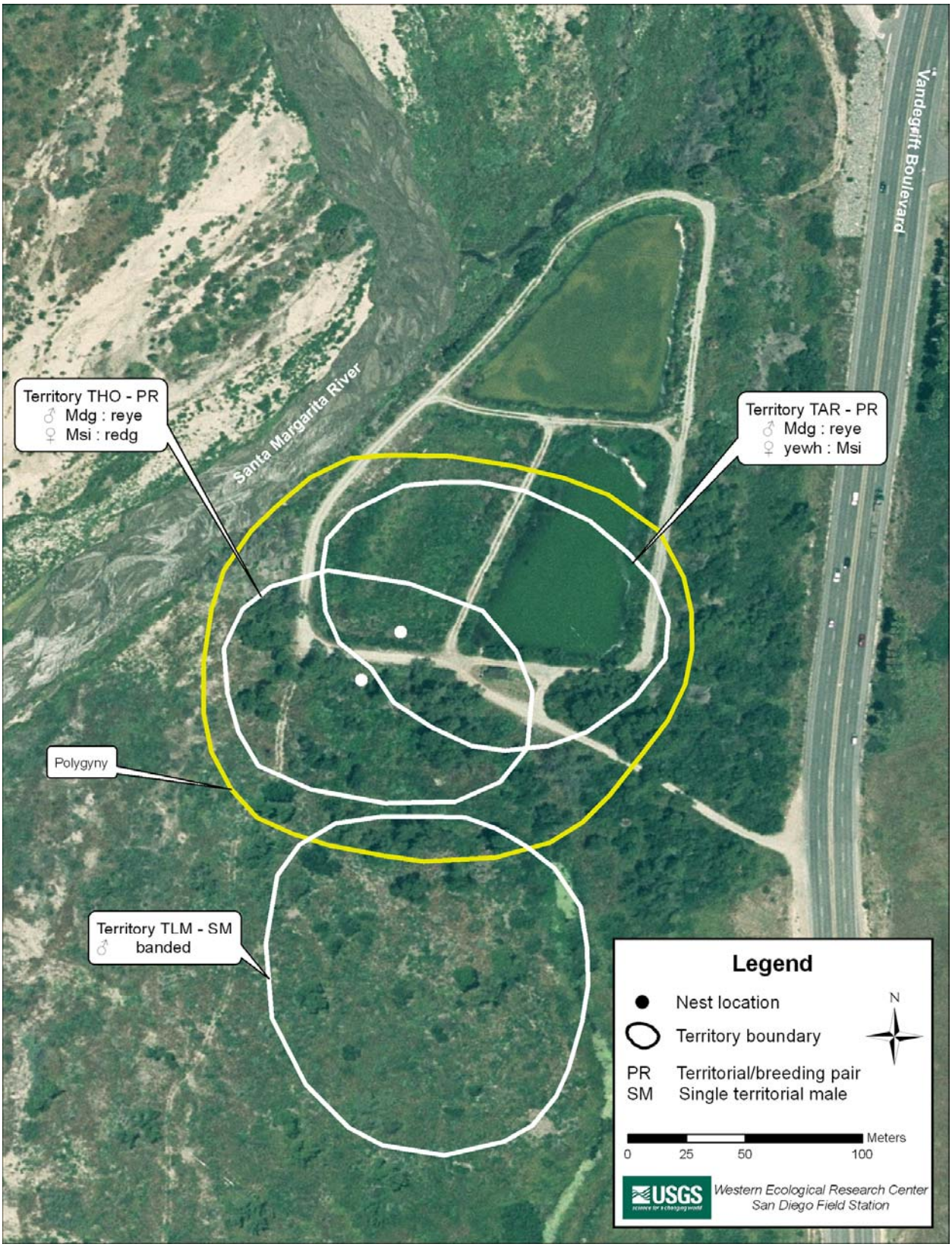

Figure 24. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Treatment Ponds Breeding Areas, Santa Margarita River.

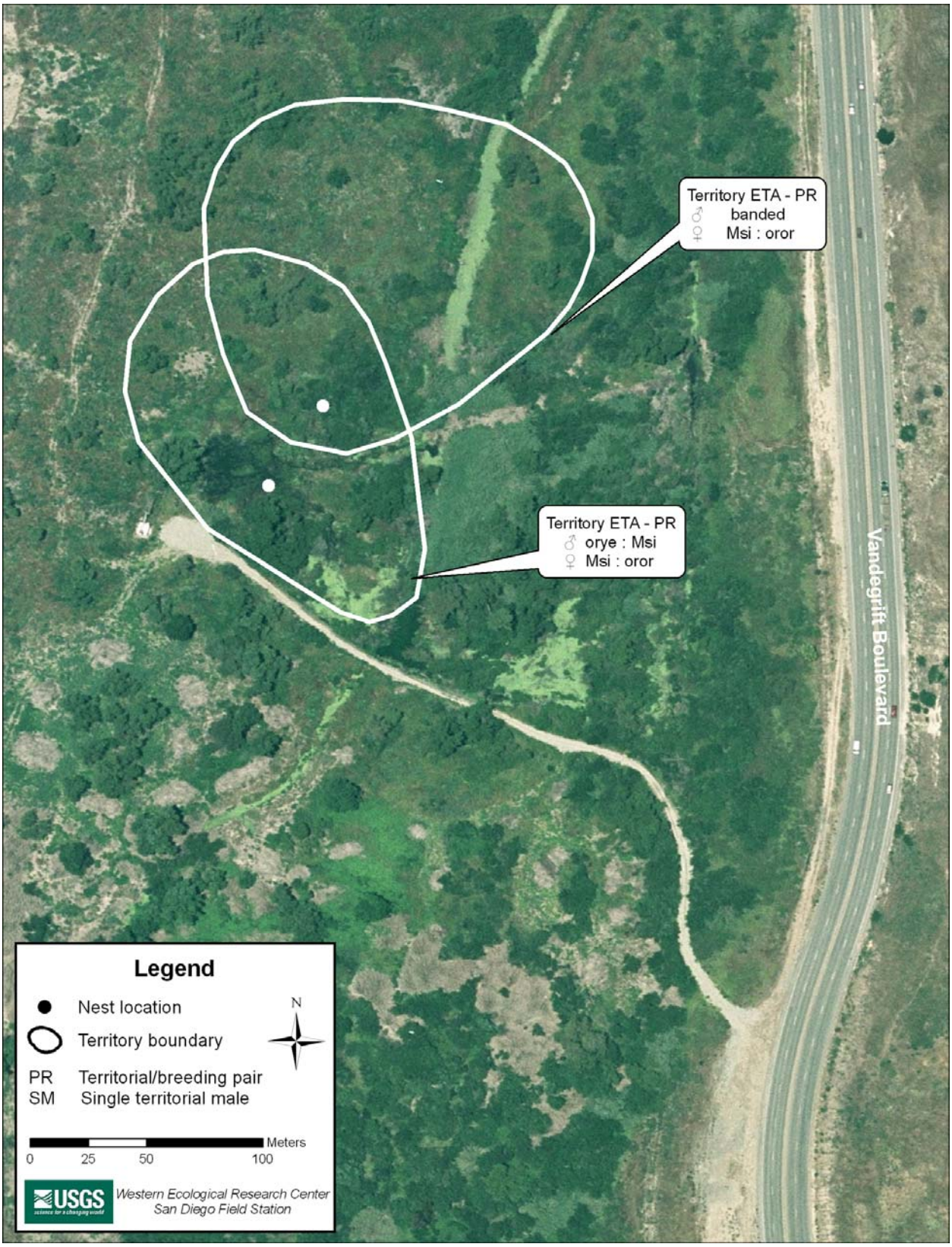

Figure 25. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Pueblitos Breeding Areas, Santa Margarita River.

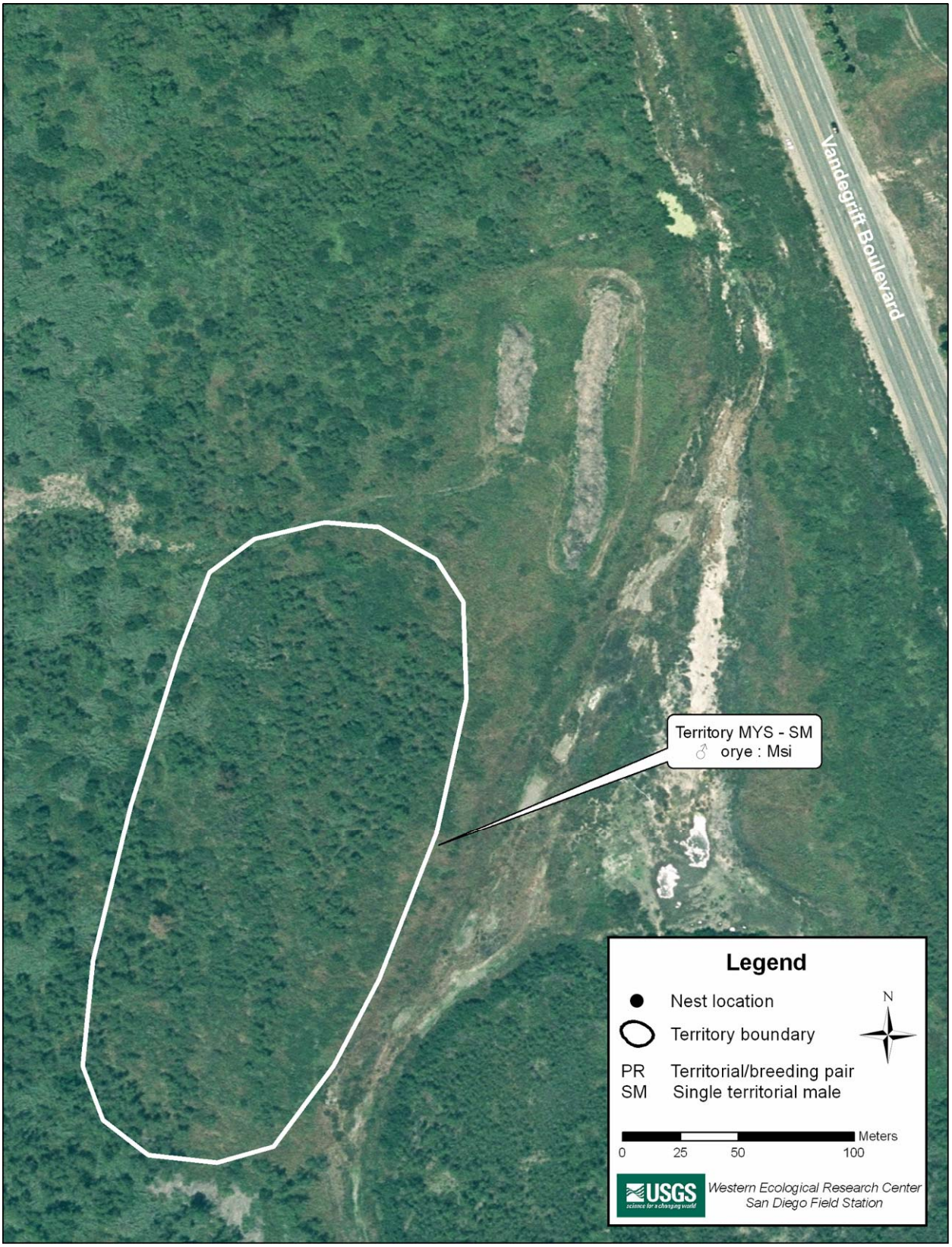

Figure 26. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Ysidora Ponds Breeding Areas, Santa Margarita River.

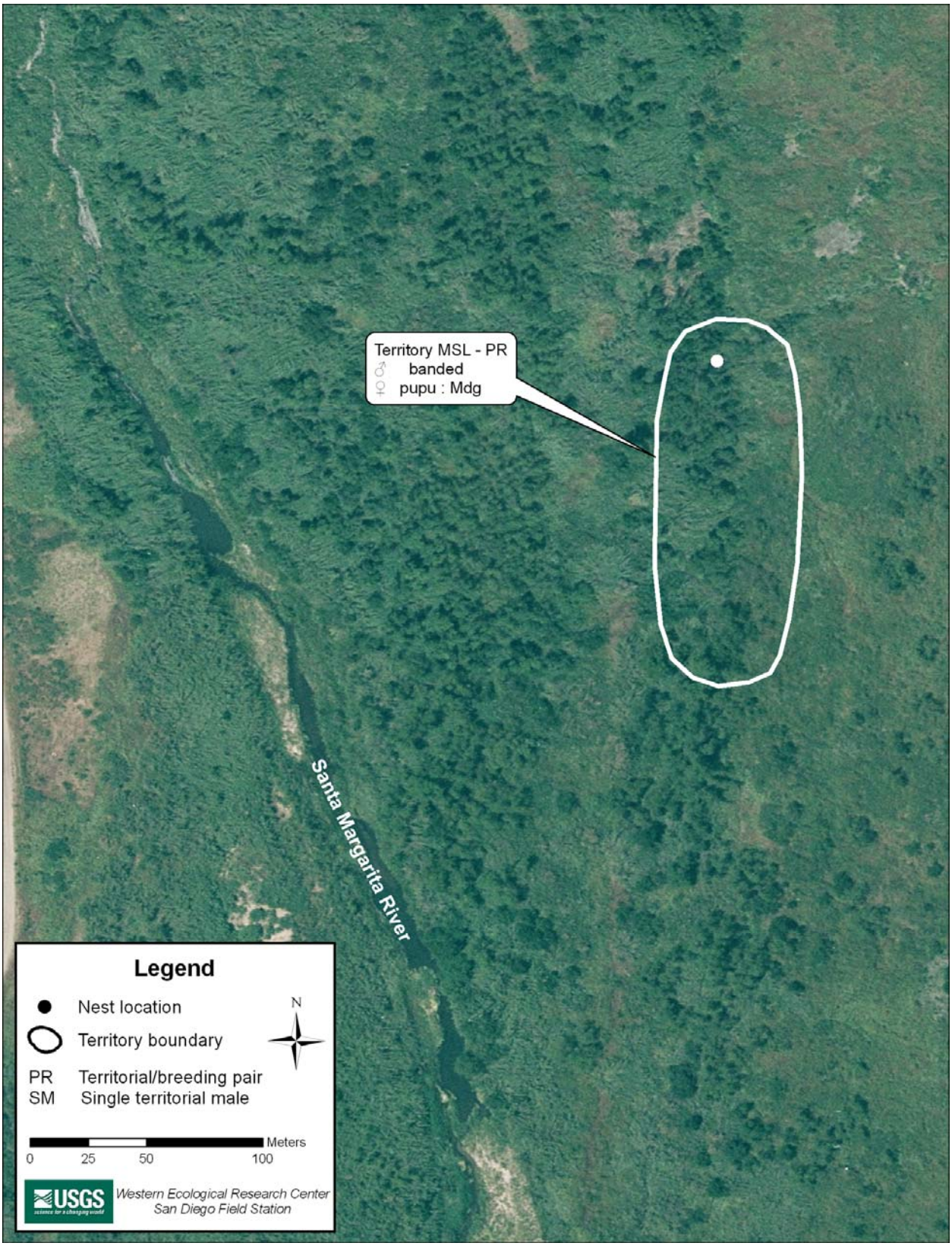

Figure 27. Southwestern willow flycatcher territories at Marine Corps Base Camp Pendleton, 2007: Bell Breeding Areas, Santa Margarita River.

APPENDIX D

BAND COMBINATIONS AND IDENTIFICATION OF SOUTHWESTERN WILLOW FLYCATCHER NESTLINGS BANDED ON MARINE CORPS BASE CAMP PENDLETON IN 2007

Band combinations and identification of southwestern willow flycatcher nestlings banded on Marine Corps Base Camp Pendleton in 2007.

Territory ID	Nest ID	Nestling Band Combination[a]	Federal Band Number
ARC	1	none : Msi	245087018
ARC	1	none : Msi	245087019
PIC	1	none : Msi	245087017
PLM	3	none : Msi	245087024
PNB	2	none : Msi	245087010
PNB	2	none : Msi	245087011
PNB	3	none : Msi	245087022
PNB	3	none : Msi	245087023
RIF	1	none : Msi	245087012
RIF	1	none : Msi	245087013
RIF	1	none : Msi	245087014
THO	1	none : Msi	245087020
THO	1	none : Msi	245087021

[a]Band combinations: left leg : right leg, Msi = federal aluminum band, none = no bands present.