



Distribution, Abundance, and Breeding Activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California

2005 Annual Report



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**

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Sacramento, California
2006

U.S. DEPARTMENT OF THE INTERIOR
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U.S. GEOLOGICAL SURVEY
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Cover photograph by Josephine Falcone

Recommended citation:

Rourke, J. W. and B. E. Kus. 2006. Distribution, abundance and breeding activities of the Least Bell's Vireo at Marine Corps Base Camp Pendleton, California. 2005 Annual Report. Prepared for Assistant Chief of Staff, Environmental Security, Marine Corps Base Camp Pendleton.

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EXECUTIVE SUMMARY

Surveys for the endangered least Bell's vireo (*Vireo bellii pusillus*) were conducted at Marine Corps Base Camp Pendleton, California, between 1 April and 15 July 2005. All drainages containing riparian habitat suitable for vireos were surveyed three to seven times. A small number of other sites containing more marginal habitat were periodically checked throughout the season for vireos. Eight hundred and twenty-seven territorial male vireos were detected over 23 drainages. Ninety-two percent of all vireo territories occurred on the nine most populated drainages, with the Santa Margarita River containing 56 percent of all territories on Base. Seventy percent of all male vireos were confirmed as paired.

The majority of vireo territories (62 percent) occurred in habitat characterized as Willow Riparian. The second most commonly used habitat type, Riparian Scrub (dominated by *Baccharis salicifolia* and/or *Salix exigua*), was occupied by 19 percent of the population. An additional eight percent of birds occupied willow habitat co-dominated by cottonwoods (*Populus fremontii*) or sycamores (*Platanus racemosa*). Habitat characterized by upland vegetation was used by 10 percent of vireos, with the remaining 1 percent occupying territories composed entirely of non-native vegetation. However, exotic plants were found to be dominant or co-dominant in approximately 20 percent of all vireo territories. The primary exotic plants found in vireo territories were poison hemlock (*Conium maculatum*), black mustard (*Brassica nigra*), giant reed (*Arundo donax*), and tamarisk (*Tamarix* spp.).

Nesting activity was monitored in 62 territories within two Giant Reed Removal and two Reference monitoring areas. Nest success and productivity estimates of pairs breeding in Reference sites did not differ appreciably from those at Removal sites. Although nesting vireos at Removal sites exhibited a higher hatching rate (67% vs. 58%; percent of all eggs that hatched) and had higher hatching success (70 % vs. 59%, percent of nests with one or more hatchlings), average clutch size, average brood size, and the average number of young fledged per pair were not statistically different from the reference sites. A large proportion of vireos at both sites were successful in fledgling young from at least one nest as 93 percent (14/15) of Reference pairs and 85 percent (17/20) of Removal pairs, within fully monitored territories, fledged young. Successful and unsuccessful nests within Reference and Removal sites did not differ statistically in average nest height, height of their host plant, or the distance the nest was placed from the edge of the host plant. Sixty to seventy-four percent of nests were placed in *S. lasiolepis*, *Baccharis salicifolia* and *S. exigua*. An additional 15 percent of all monitored nests were placed in two exotic species, *C. maculatum* and *B. nigra*, reflecting the disturbed nature of many of the nest sites. Thirty-three percent (3/9) of the nests built in *C. maculatum* failed when the branch supporting the nest, or the entire nest substrate, gave way under the weight of the growing nestlings, dumping the young on the ground. Predation was believed to be the primary source of nest failure at both sites.

One hundred thirty-four least Bell's vireos were banded during the 2005 season. These included 36 adult vireos that were target netted and banded with a unique color combination; 96 hatch-year birds, 91 of which were banded as nestlings and five of which were incidentally caught while attempting to target net an adult vireo in a territory; and two vireos of undetermined age. Previously banded returning adult vireos ranged from two to seven years old.

INTRODUCTION

The least Bell's vireo (*Vireo bellii pusillus*; hereafter "vireo") is a small, migratory, songbird that breeds in southern California and northwestern Baja California, Mexico from April through July. Historically abundant within lowland riparian ecosystems, vireo populations began declining in the late 1900's as a result of habitat loss and alteration associated with urbanization and conversion of land adjacent to rivers to agriculture (Franzreb 1989, USFWS 1998, RHJV 2004). Additional factors contributing to the vireo's decline have been the expansion in range of the brown-headed cowbird (*Molothrus ater*), a brood parasite, to include the Pacific coast (USFWS 1986; Franzreb 1989; Brown 1993; Kus 1998, 1999), and the introduction of invasive exotic plant species, such as giant reed (*Arundo donax*), into riparian systems. By 1986 the vireo population in California numbered just 300 territorial males (USFWS 1986).

In response to the dramatic reduction in numbers of least Bell's vireos in California, the California Fish and Game Commission listed the species as endangered in 1980, with the U.S. Fish and Wildlife Service following suit in 1986. Since listing, the vireo population in southern California has rebounded, largely in response to cowbird control, and habitat restoration and preservation (Kus and Whitfield 2005). As of 2004, the statewide vireo population was estimated to be approximately 2500 territories (USGS, unpublished data), roughly a third of which occurred on Camp Pendleton.

Male least Bell's vireos arrive on breeding grounds in southern California in mid-March. Male vireos are conspicuous, and frequently sing their diagnostic primary song throughout the breeding season from exposed perches. Females arrive approximately 1-2 weeks after males and are more secretive, but are often seen early in the season traveling through habitat with the male. The female, with the male's help, builds an open cup nest in dense vegetation approximately one meter above the ground. Typical clutch size for least Bell's vireos average 3-4 eggs. Typically, the female and male incubate the eggs for 14 days, with young fledging from the nest at 11-12 days of age. It is not unusual for vireos to re-nest after a failed attempt provided ample time remains within the breeding season. Vireos rarely fledge more than one brood in a season. Nesting lasts from early April through July, but adults and juvenile birds remain on the breeding grounds into late September/early October before migrating to their wintering grounds in southern Baja California, Mexico.

The purpose of this study was to document the status of least Bell's vireo at Marine Corps Base Camp Pendleton in San Diego County, California. Specifically, our goals were to (1) determine the size and composition of the Bell's vireo population at the Base, (2) characterize habitat used by vireos, (3) band a subset of vireos to facilitate the estimation of vireo survivorship and movement in future years, and (4) assess the short-term effects of giant reed removal on vireo fecundity, nest success, and productivity by establishing nest monitoring plots in areas that had recently undergone giant reed removal and at reference sites in which giant reed was removed five to eight years earlier, between 1997 and 2000. 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 vireos between 1 April and 15 July 2005. Field work was conducted by Luke Caldwell, Douglas Chamblin, Robert Chapman, Daniel Evans, Dana Kamada, Kerry Kenwood, Barbara Kus, Michelle Rogne, James Rourke, Helen Sofaer, Khara Strum, and Michael Wellik. The specific areas surveyed are as follows:

1. *Santa Margarita River:*

- a. Between Interstate 5 upstream to the confluence with De Luz Creek, including all riparian habitat within Stagecoach Canyon and Ysidora Basin east of Vandegrift Road (Figures 1, 2).
- b. From the confluence with De Luz Creek upstream to the Base boundary (Figure 2).

2. *De Luz Creek,* between the confluence with the Santa Margarita River and the Base boundary (Figure 1).

3. *Roblar Creek,* between the confluence with De Luz Creek and a point approximately one kilometer upstream (Figure 1).

4. *Lake O'Neill/Fallbrook Creek:*

- a. All riparian habitat around Lake O'Neill (Figure 1).
- b. Between Lake O'Neill and the Base boundary with the Fallbrook Naval Weapons Station (Figure 1).

5. *Basilone and Roblar Roads,* a small patch of habitat straddling Basilone Road at the intersection of Basilone and Roblar Roads (Figure 1).

6. *22 Area,* all riparian habitat within the 22 Area, east of Vandegrift Road and the Supply Depot (Figure 2).

7. *Pueblitos Canyon,* between Vandegrift Road and a point approximately 2.5 kilometers upstream (Figure 2).

8. *Newton Canyon*, between the confluence with the Santa Margarita River and the upstream limit of riparian habitat (Figure 2).
9. *Cockleburr Canyon*, between the Pacific Ocean and a point 0.25 kilometers east of Interstate 5 (Figure 2).
10. *French Creek*, between the Pacific Ocean and the Edson Range Impact Area (Figure 2).
11. *Aliso Creek*, between the Pacific Ocean and 0.5 kilometers upstream of the electrical transmission lines (Figure 2).
12. *Hidden Canyon*, between Interstate 5 and Stuart Mesa Road (Figure 3).
13. *Las Flores Creek (within Las Pulgas Canyon)*:
 - a. Between Stuart Mesa Road and the high voltage electrical transmission lines (Figure 3).
 - b. Between the Pacific Ocean and Stuart Mesa Road, and from the high voltage electrical transmission lines upstream to the Zulu Impact Area point, approximately 0.75 kilometers upstream of Basilone Road (Figure 3).
14. *Piedra de Lumbre Canyon*, between the confluence with Las Flores Creek and the upstream limit of riparian habitat (Figure 3).
15. *Horno Canyon*, between Old Highway 101 and the upstream limit of riparian habitat (Figure 3).
16. *San Onofre Creek*:
 - a. From the Pacific Ocean to the south fork/north fork confluence, and upstream on the south fork to Basilone Road (Figures 3, 4).
 - b. From Basilone Road upstream to the access road to range 219 (Figure 4).
17. *San Mateo Creek*:
 - a. From the Pacific Ocean upstream to San Mateo Road, including habitat south of the creek and south and east of the agricultural fields (Figures 4).
 - b. From San Mateo Road upstream to the Yankee training area boundary (Figure 4). Road closures resulting from flooding prevented surveys being conducted upstream to the Base boundary as stipulated by the Scope of Work.
18. *Cristianitos Creek*, between the confluence with San Mateo Creek and the Base boundary (Figure 4).
19. *Talega Canyon*, between the confluence with Cristianitos Creek and a point approximately 6.5 kilometers upstream (Figure 4).

20. Pilgrim Creek:

- a. Between the southern Base boundary and Vandegrift Boulevard, including the two side drainages east of Pilgrim Creek (Figure 5).
- b. From Vandegrift Boulevard upstream to the limit of riparian habitat (Figure 5).

21. Windmill Canyon, from the Base boundary passed the golf course to the upstream extent of habitat (includes both the 2004 Windmill Canyon and Horse Pasture sites) (Figure 5).

22. Ysidora Basin to Windmill Canyon, between Upper Ysidora Basin and Windmill Canyon/Pueblitos Canyon (Figure 5).

23. De Luz Homes Habitat, patches of habitat adjacent to the De Luz Homes development (Figure 5).

The majority of drainages were surveyed from three to seven times at least ten days apart. A small number of locations containing suitable vireo habitat were surveyed one to two times to check for vireo occupancy. Sites surveyed seven times throughout the breeding season were: Santa Margarita River (1a), Lake O'Neill/Fallbrook Creek (4a), Las Flores Creek (13a), and Pilgrim Creek (20a). Sites surveyed six times included: De Luz Creek, Aliso Creek, Las Flores Creek (13b), San Onofre Creek (16a), San Mateo Creek (17b), and Cristianitos Creek. Sites surveyed three times were: Santa Margarita River (1b, road closures and inaccessibility resulting from flooding caused the upper half of the site to be surveyed only once), Lake O'Neill/Fallbrook Creek (4b), 22 Area, Pueblitos Canyon, Newton Canyon, French Creek, Hidden Canyon, Piedra de Lumbre Canyon, San Onofre Creek (16b), San Mateo Creek (17b), Pilgrim Creek (20b), and Windmill Canyon. Sites checked one or two times for vireos included: Basilone and Roblar Roads, Ysidora Basin to Windmill Canyon, and De Luz Homes Habitat.

Biologists followed standard survey techniques described in the Least Bell's Vireo Working Group and USFWS least Bell's vireo survey guidelines (USFWS 2001). Observers moved slowly (1-2 km per hour) through the riparian habitat while searching and listening for vireos. 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 to detect 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), sex, breeding status (paired, unpaired, undetermined, or transient), and whether the bird was banded. Birds were considered transients if they were not detected on two or more consecutive surveys after an initial detection. Vireo 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 (WGS84). Dominant native and exotic plants were recorded, and percent cover of exotic vegetation estimated using cover categories of <5%, 5-50%, 51-95%, and >95%. Overall habitat type was specified according to the following categories:

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 woody species.

Upland scrub: Disturbed coastal sage scrub adjacent to riparian habitat.

Non-native: Sites vegetated exclusively with non-native species such as *Arundo donax* and *Tamarix ramosissima*.

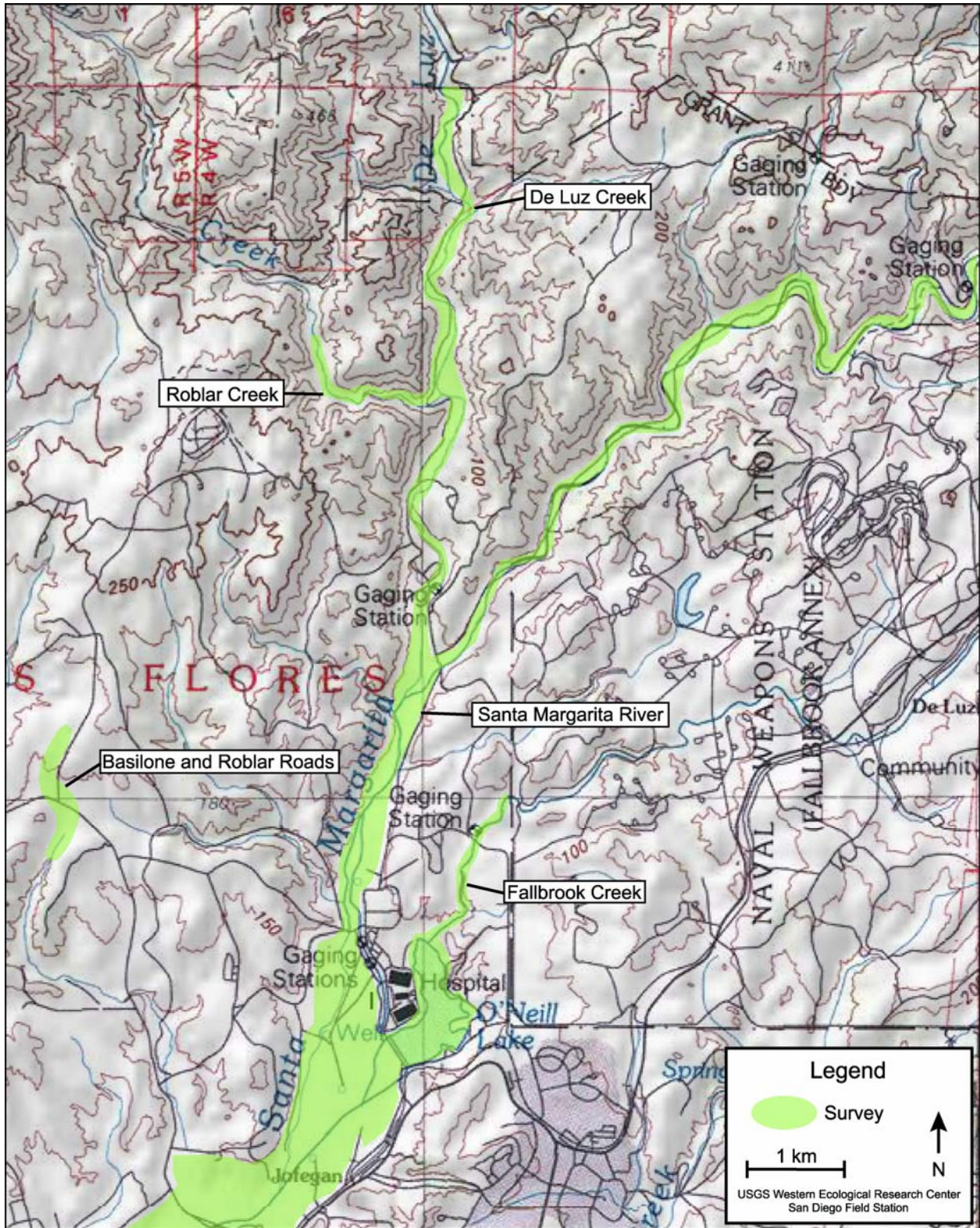


Figure 1. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River, Fallbrook Creek, De Luz Creek, Roblar Creek, and Basilone and Roblar Roads.

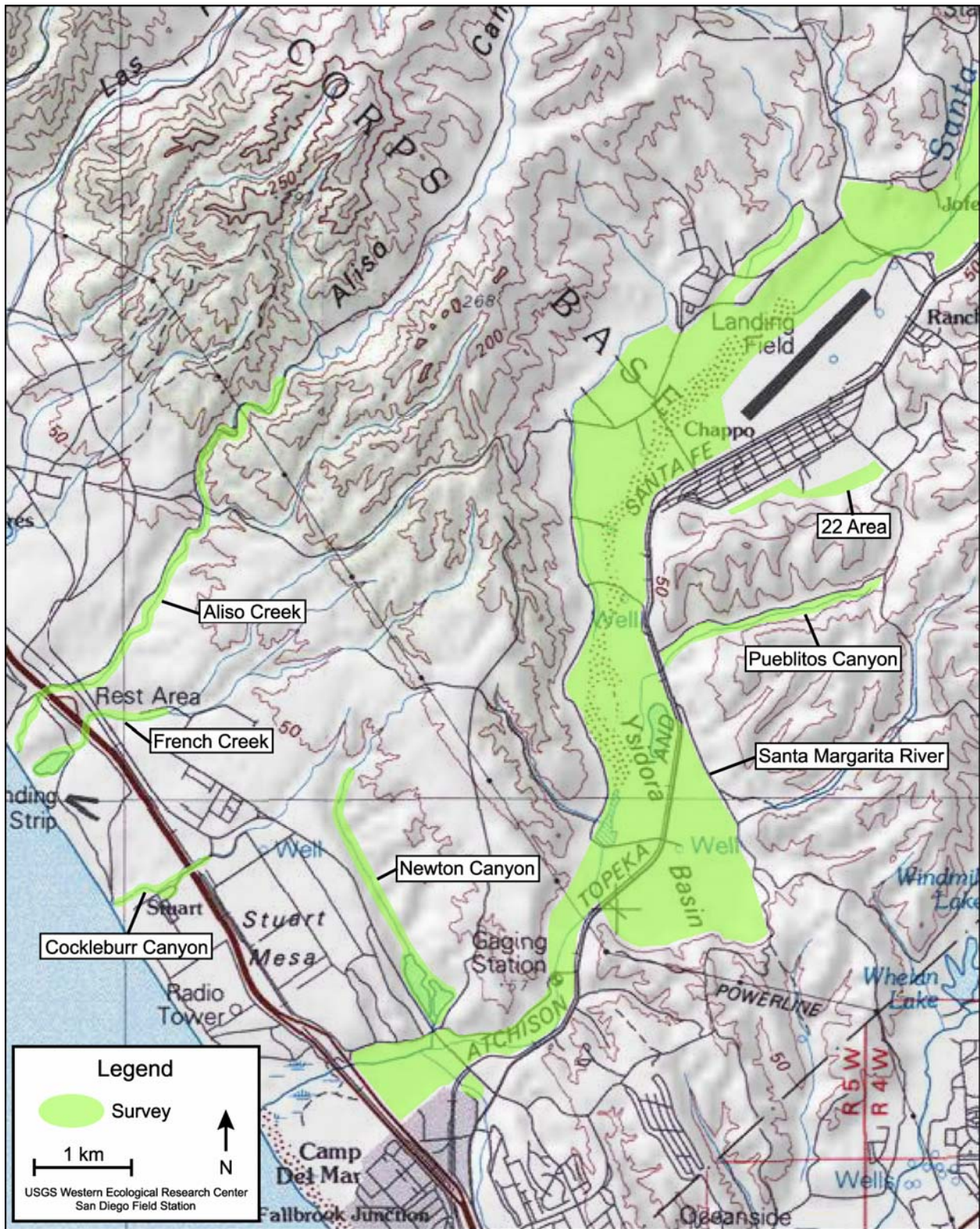


Figure 2. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Lower Santa Margarita River, 22 Area, Pueblitos Canyon, Newton Canyon, Cocklebur Canyon, French Creek, and Aliso Creek.



Figure 3. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek South Fork, Horno Canyon, Piedra de Lumbre Canyon, Las Flores Creek, and Hidden Canyon.

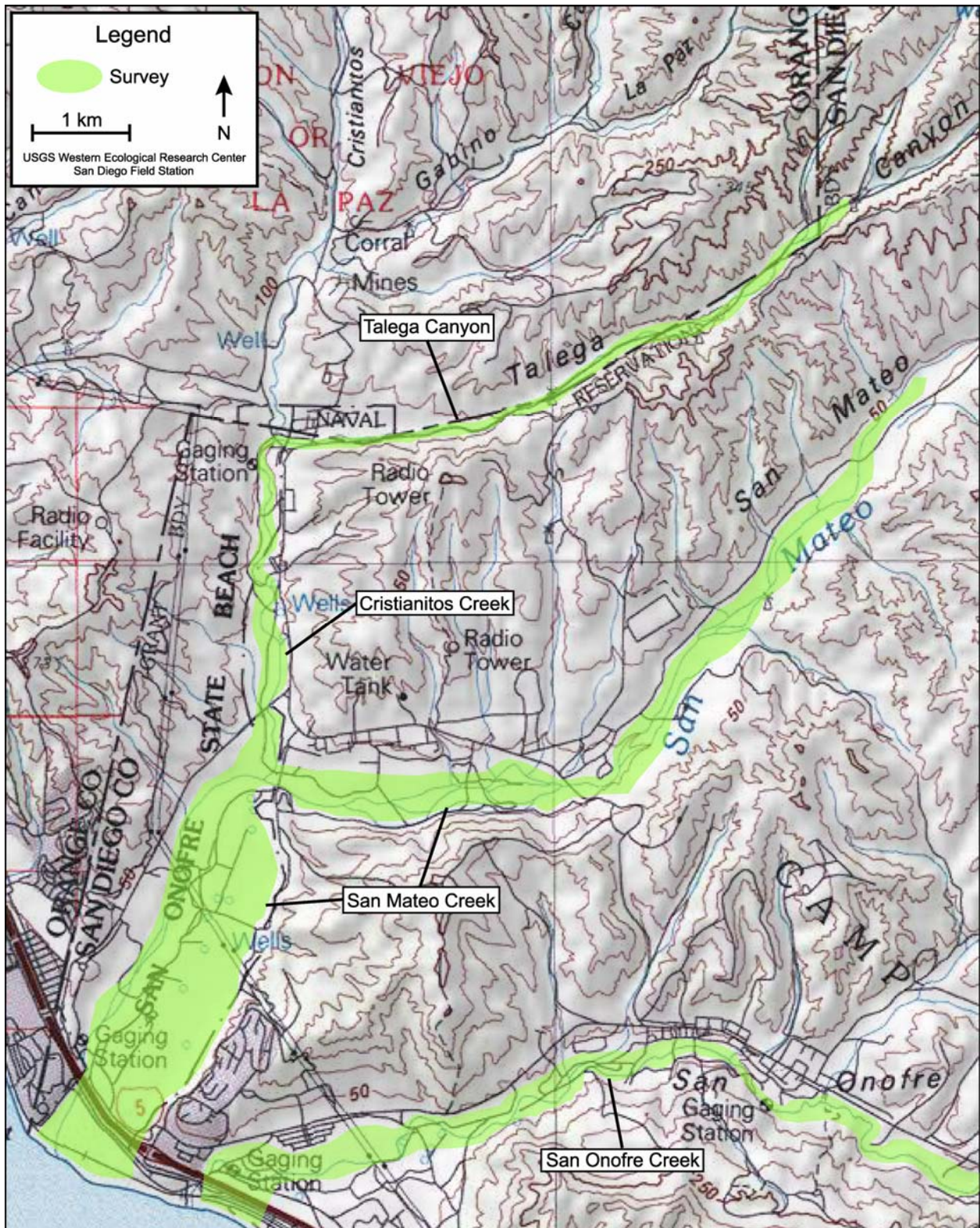


Figure 4. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Talega Canyon, Cristianitos Creek, San Mateo Creek, and San Onofre Creek.

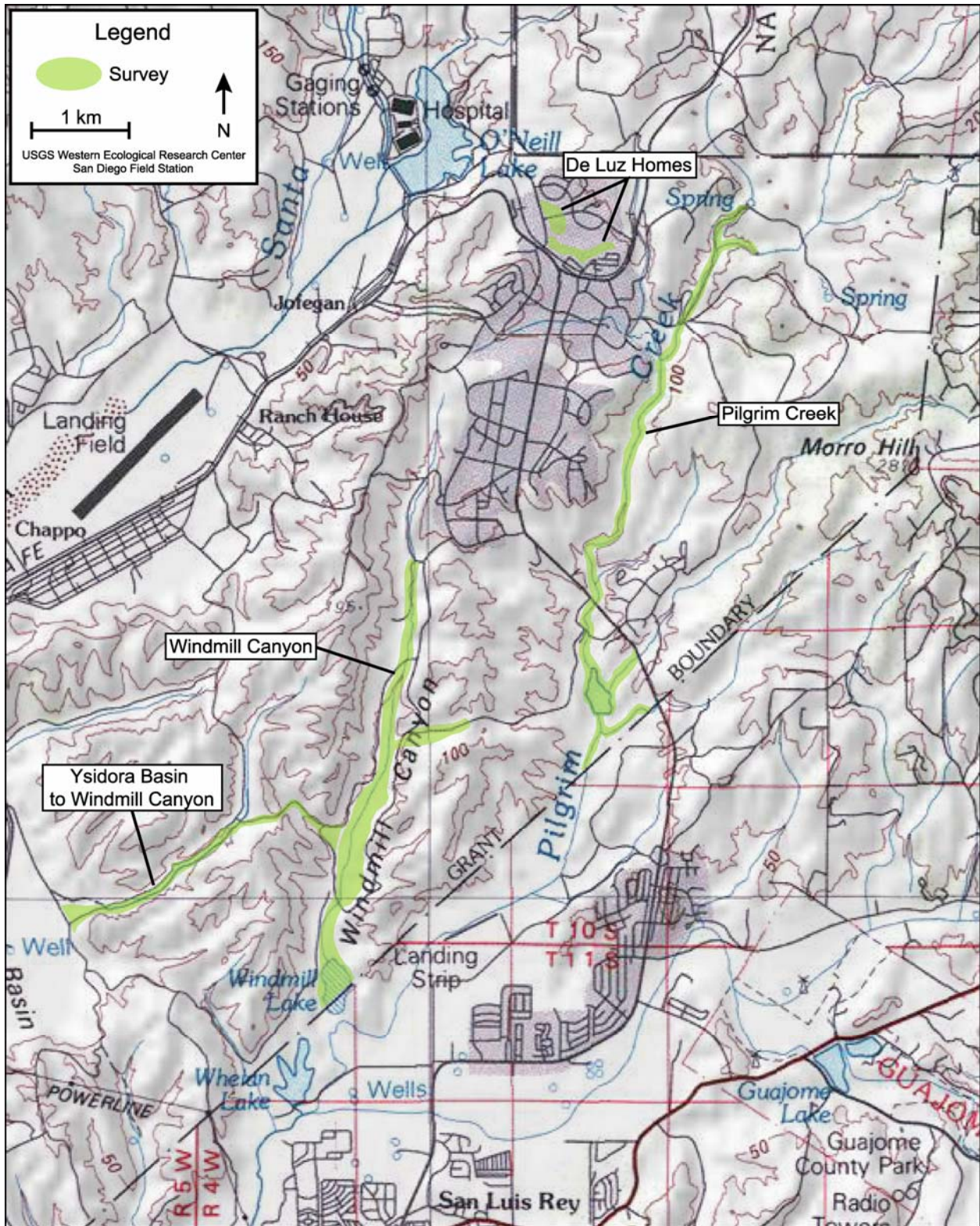


Figure 5. Least Bell's vireo survey areas at Marine Corps Base Camp Pendleton, 2005: Windmill Canyon, Ysidora Basin to Windmill Canyon, Pilgrim Creek, and habitat adjacent to De Luz Homes.

Nest Monitoring

We monitored least Bell's vireo nests to evaluate the effects of giant reed removal on nest success and productivity. Giant reed is a highly invasive, non-native plant within riparian systems in southern California. Originally introduced for bank stabilization in the 1800's, giant reed has become a major component of many riparian systems, becoming the dominant vegetation within streams and rivers. As part of a riparian restoration effort, Marine Corps Base Camp Pendleton has been removing large quantities of giant reed on the Santa Margarita River. Areas that have recently undergone giant reed removal tend to consist of small patches of native woody plants surrounded by large areas of bare earth. These open areas are typically populated by native and non-native herbaceous plants until the appropriate conditions arise that allow for the establishment of native woody species, such as *B. salicifolia*, *S. exigua*, *S. gooddingii*, *S. lasiolepis*, and *S. laevigata*. We established four monitoring areas: two sites within locations in which giant reed was removed historically and the native vegetation recovered (hereafter referred to as "Reference" sites), and two sites in areas where giant reed had been removed within the previous three years (hereafter "Removal" sites; Figure 6).

Thirty-eight pairs in Reference sites and 24 pairs in Removal sites were monitored throughout the season and all nesting activity documented. Pairs were observed for evidence of nesting, and their nests were located. Nests were visited as infrequently as possible to minimize the chances of leading predators or brown-headed cowbirds to nest sites; typically, there were four to six visits per nest. The first visit was timed to determine the number of eggs laid, the next few visits to determine hatching and age of young, the next to band nestlings (see below), and the last to confirm fledging. Characteristics of nests, including height, host species, and host height were recorded following abandonment or fledging of nests.

Banding

The primary goal of banding least Bell's vireos on Camp Pendleton is: 1) to better understand adult vireo site fidelity within a potential source population, 2) to investigate natal dispersal on Base, and the role Camp Pendleton young play in potentially supporting vireo populations off Base, and 3) to understand how giant reed removal affects vireo demography. Nestlings from monitored nests were banded at 5-8 days of age with a single anodized gold numbered federal band on the right leg. A limited number of adult vireos within monitoring and prospective giant reed removal sites were captured in mist nets and banded with a unique combination of colored plastic and anodized metal bands. Adults previously banded with a single numbered federal band were target netted to determine their identity, and their original band was supplemented with other bands to generate a unique color combination. If the adult was originally banded on Base, either an anodized gold or orange plastic band was incorporated into the combination to designate Camp Pendleton as the bird's site of origin.

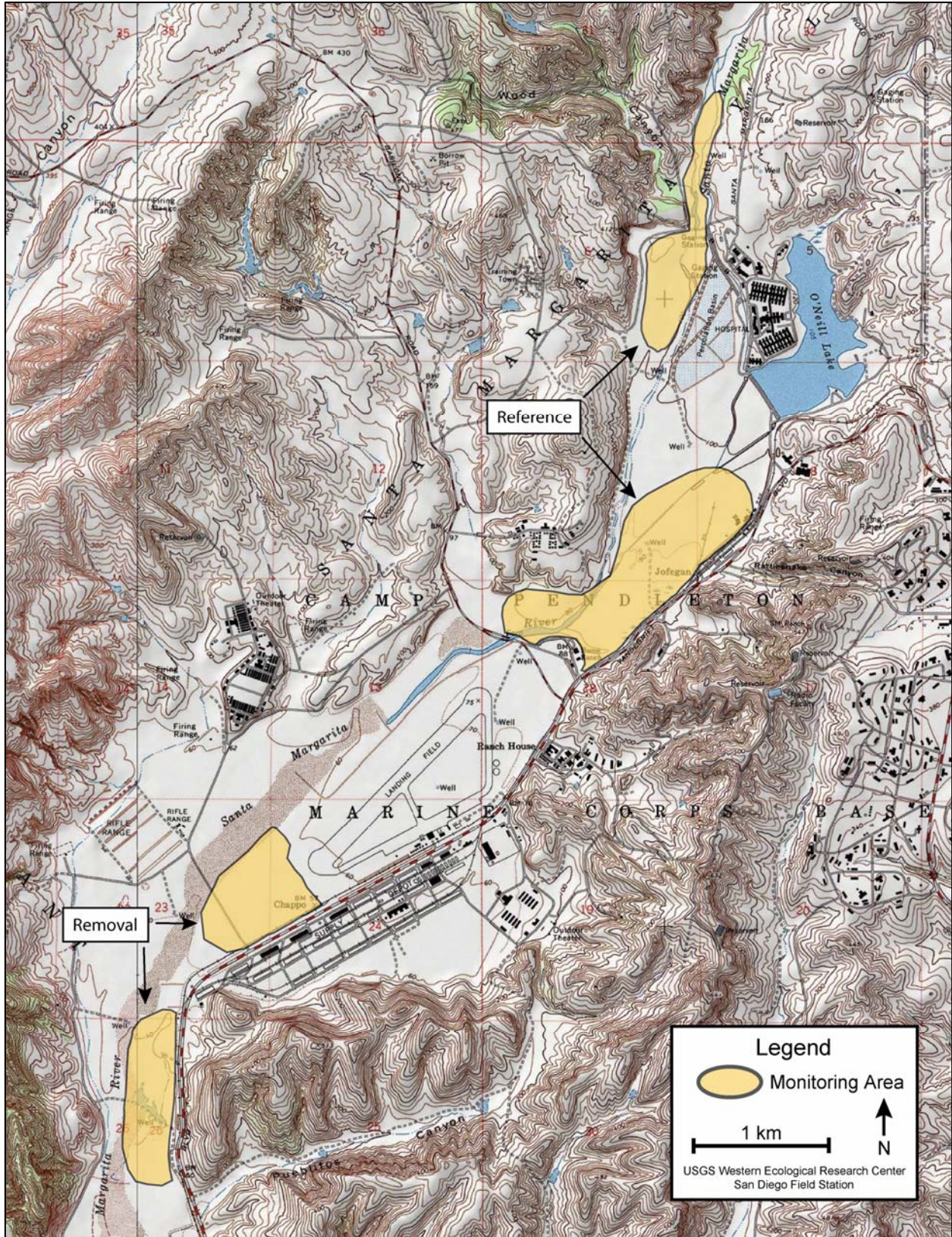


Figure 6. Location of least Bell's vireo nest monitoring areas on Marine Corps Base Camp Pendleton, 2005.

RESULTS

Population Size and Distribution

Eight hundred and sixty-seven least Bell's vireo sites were identified during Base-wide surveys (Table 1, Figures 7-25). This included 827 territorial male vireos, 70 percent of which were confirmed as paired, and 40 transients. Transient vireos were observed on 13 of the 23 (56%) drainages/sites surveyed. Ninety-two percent of all vireo territories occurred on the nine most populated drainages (i.e., Santa Margarita River, Las Flores Creek, San Mateo Creek, San Onofre Creek, Pilgrim Creek, Aliso Creek, Lake O'Neill/Fallbrook Creek, De Luz Creek, and

Table 1. Number and distribution of least Bell's vireos at Camp Pendleton, 2005.

Drainage/Survey Site	Known Pairs	Single/Status Unknown	Transient	Territories
Santa Margarita River:				
I-5 to De Luz Creek	335	113	17	448
De Luz Creek to Base Boundary	1	13	0	14
De Luz Creek	14	4	2	18
Roblar Creek	0	0	0	0
Lake O'Neill/Fallbrook Creek	7	13	4	20
Basilone-Roblar Roads	0	2	0	2
22 Area	8	2	1	10
Pueblitos Canyon	5	0	1	5
Newton Canyon	7	1	1	8
Cocklebur Creek	1	1	0	2
French Canyon	4	2	0	6
Aliso Creek	15	6	2	21
Hidden Canyon	6	2	0	8
Las Flores Creek:				
Pacific Ocean to Stuart Mesa Rd	1	0	0	1
Stuart Mesa Rd to Power Lines	21	23	2	44
Power Lines to Zulu Impact Area	31	9	1	40
Piedre de Lumbre Canyon	5	3	2	8
Horno Canyon	1	0	0	1
San Onofre Creek:				
Pacific Ocean to Basilone Rd	0	3	0	3
Basilone Rd to Access Rd to Range 219	32	17	1	49
San Mateo Creek				
Pacific Ocean to San Mateo Rd	38	10	3	48
San Mateo Rd to Yankee Training Area	3	5	1	8
Cristianitos Creek	3	3	1	6
Talega Canyon	1	0	0	1
Pilgrim Creek:				
Base Boundary upstream to Vandegrift Blvd	24	4	0	28
Vandegrift Blvd to upstream riparian limit	4	4	1	8
Windmill Canyon	7	5	0	12
Ysidora Basin to Windmill Canyon	0	4	0	4
De Luz Homes	2	2	0	4
Total	576	251	40	827

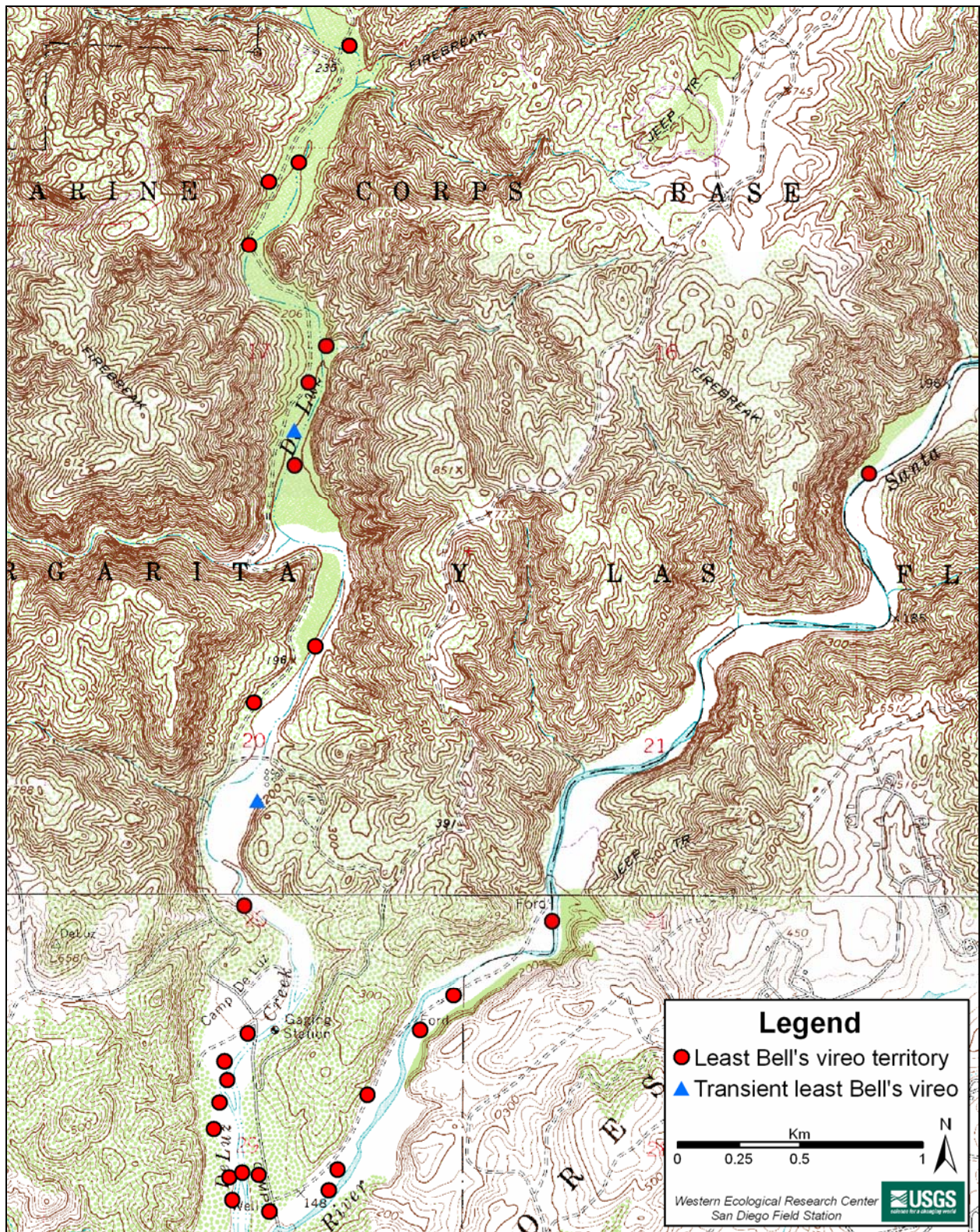


Figure 7. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River, De Luz Creek, and Roblar Creek.

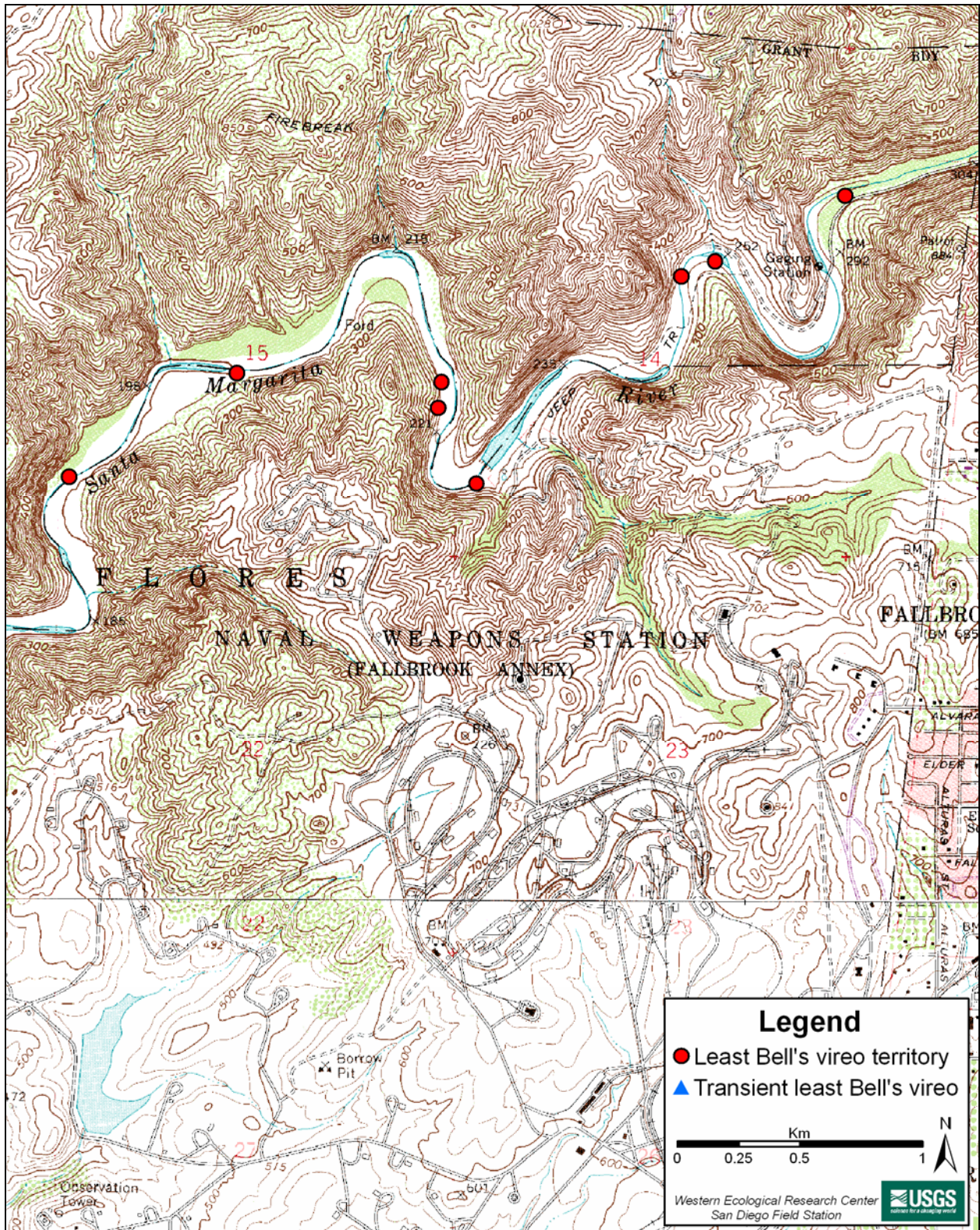


Figure 8. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Upper Santa Margarita River.

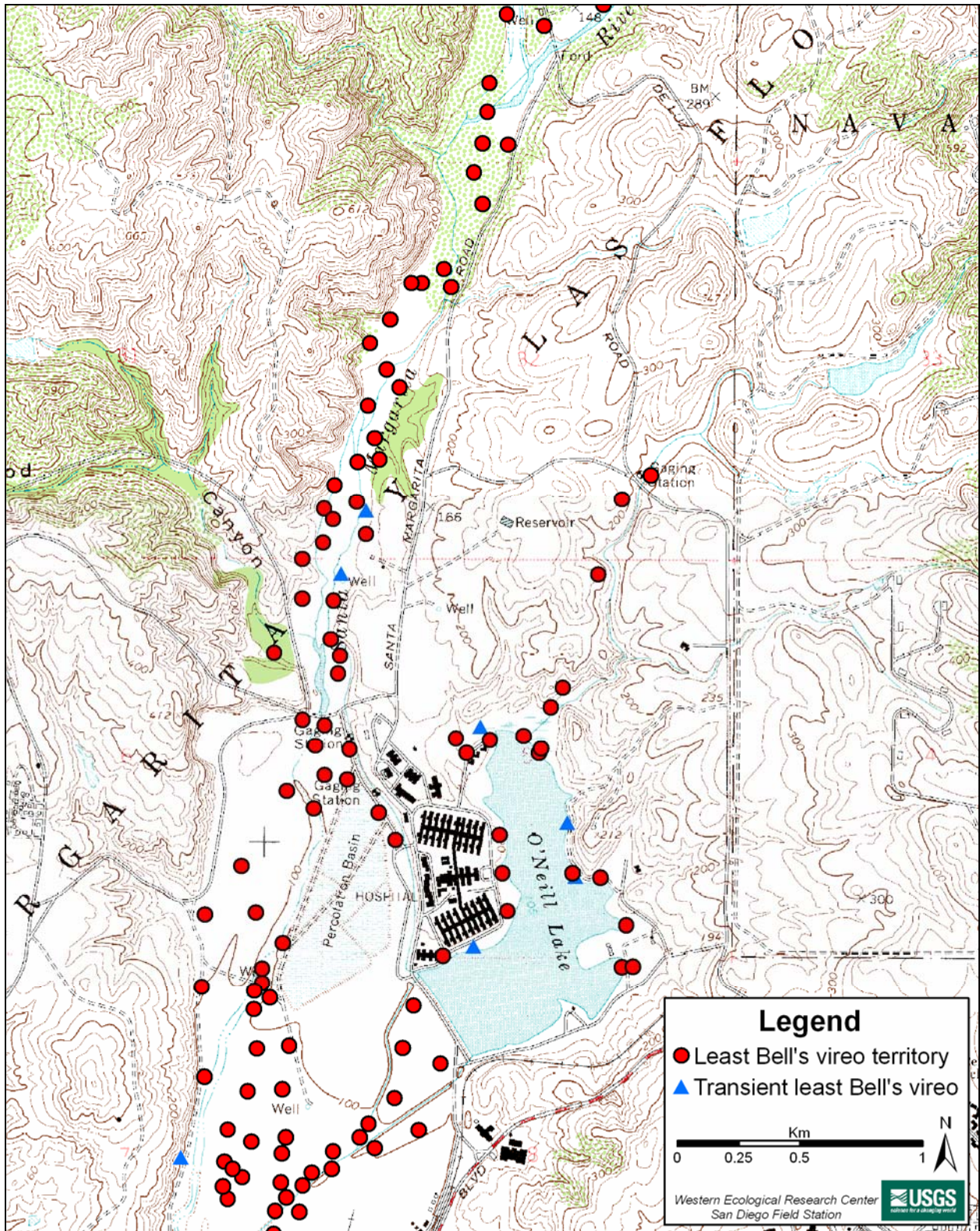


Figure 9. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Lake O'Neill, Fallbrook Creek, and Santa Margarita River.

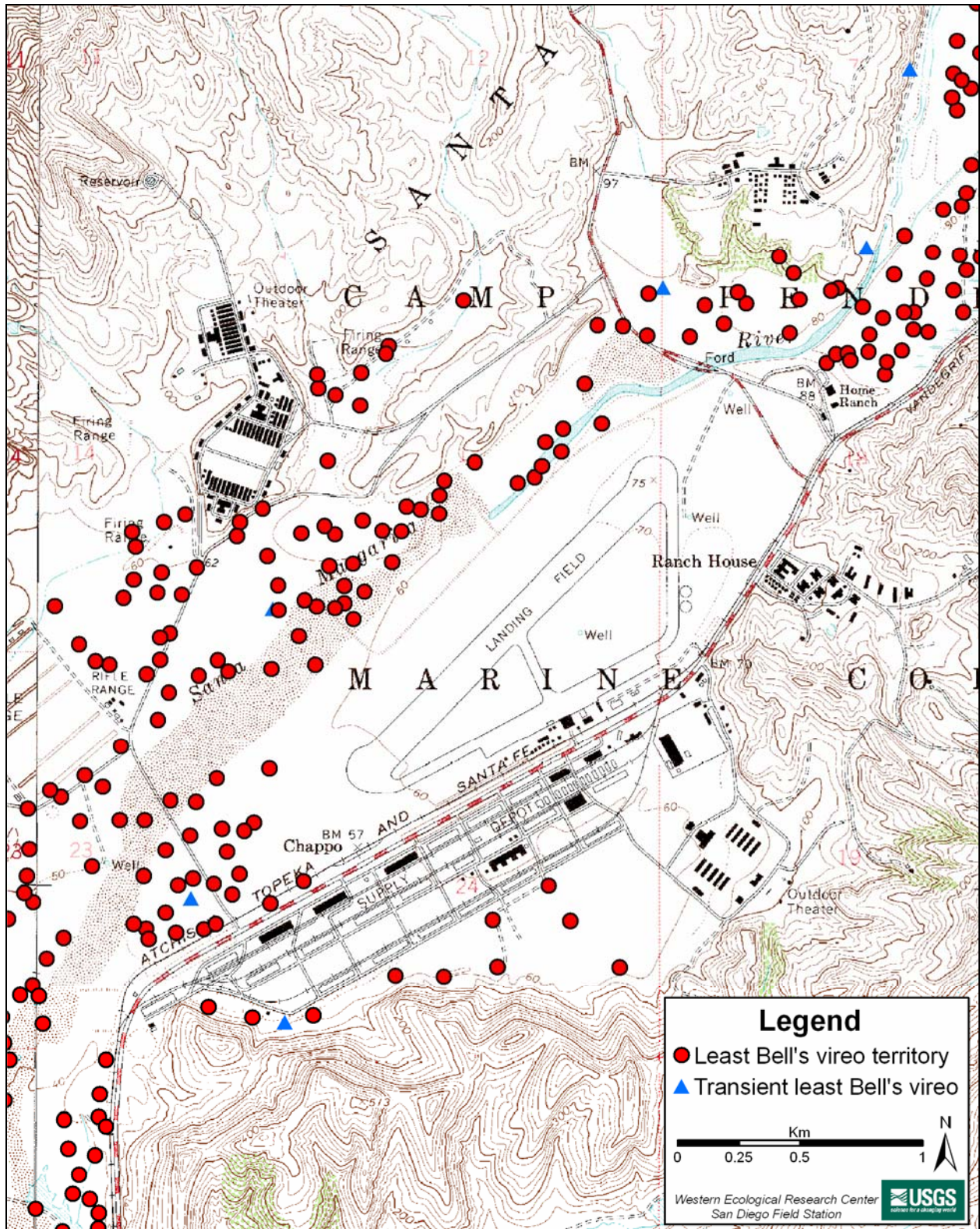


Figure 10. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Air Station, Santa Margarita River, and Area 22.

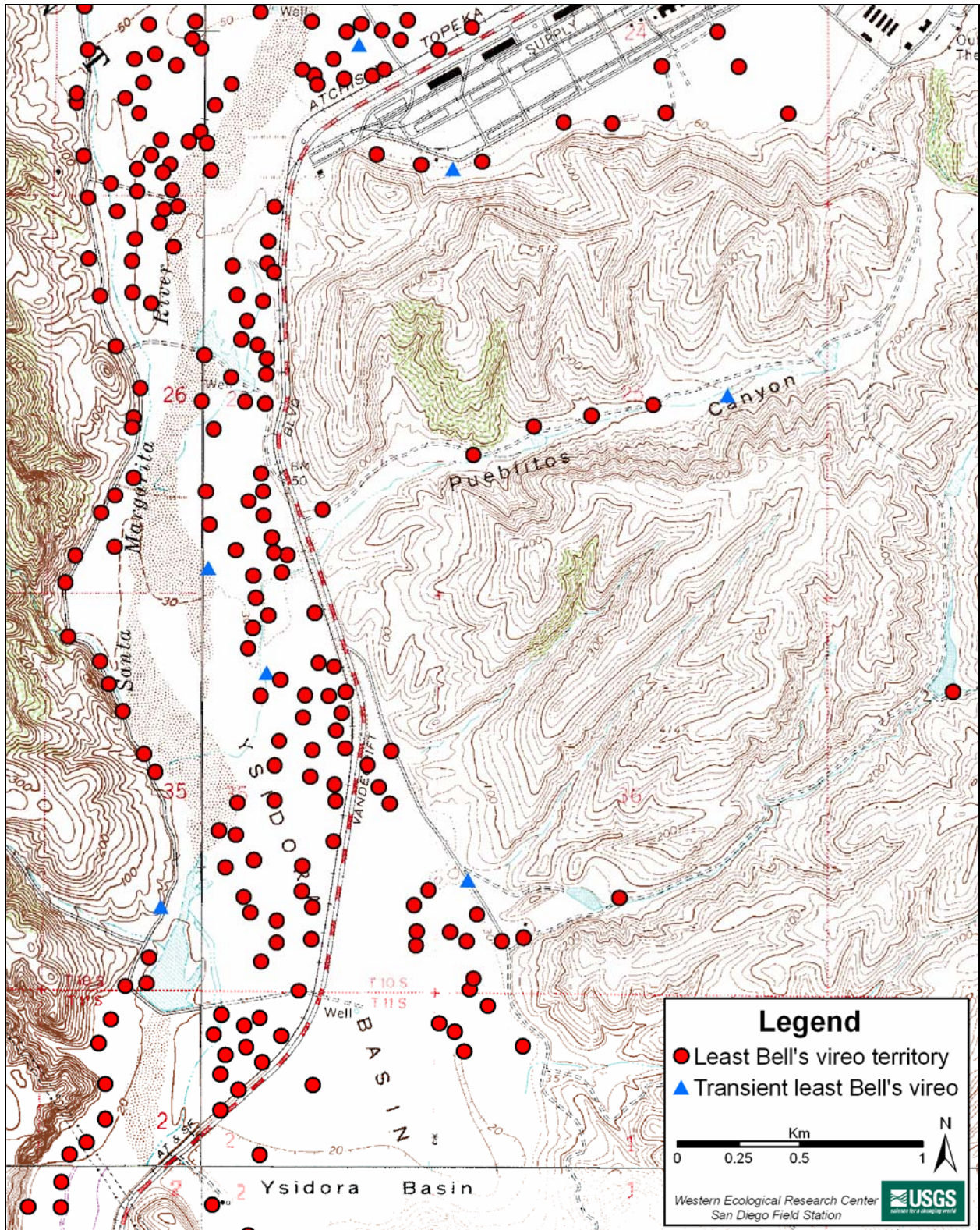


Figure 11. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Ysidora Basin, Santa Margarita River, Pueblitos Canyon, and Ysidora Basin to Windmill Canyons.

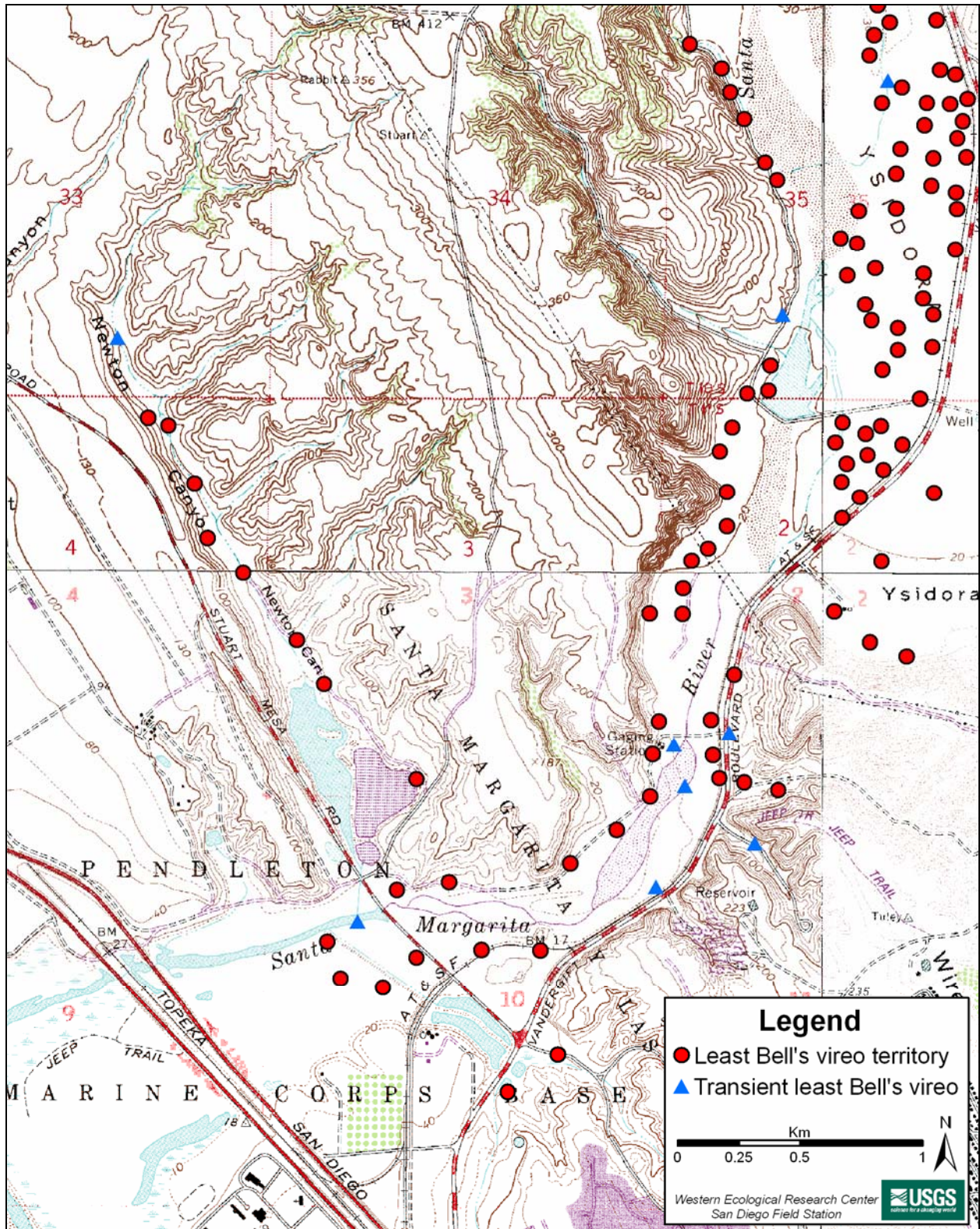


Figure 12. Locations of least Bell's vireos at Marine Corps Base Camp Pendleton, 2005: Lower Santa Margarita River and Newton Canyon.

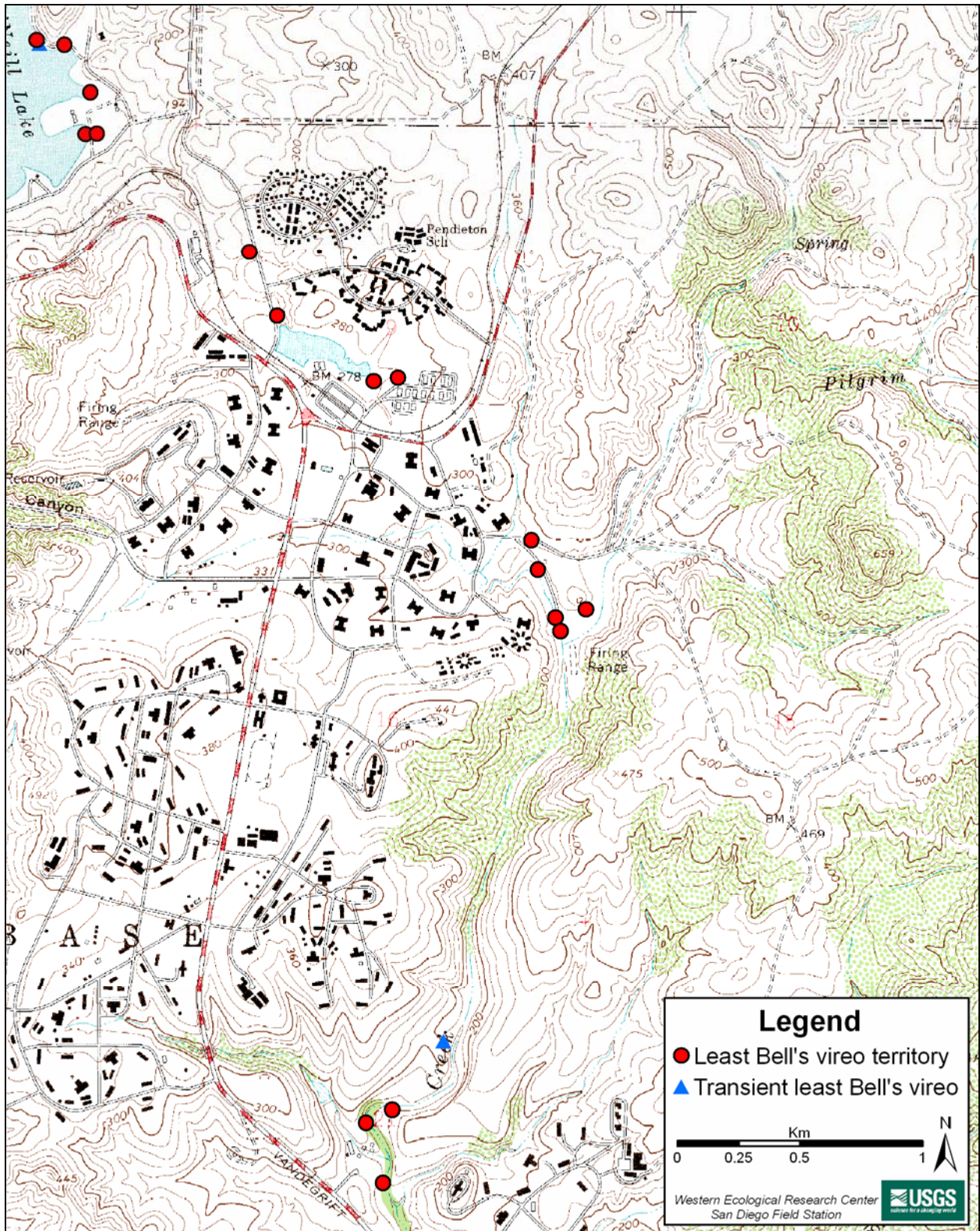


Figure 13. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper Pilgrim Creek, De Luz Homes Habitat, and Lake O'Neill.

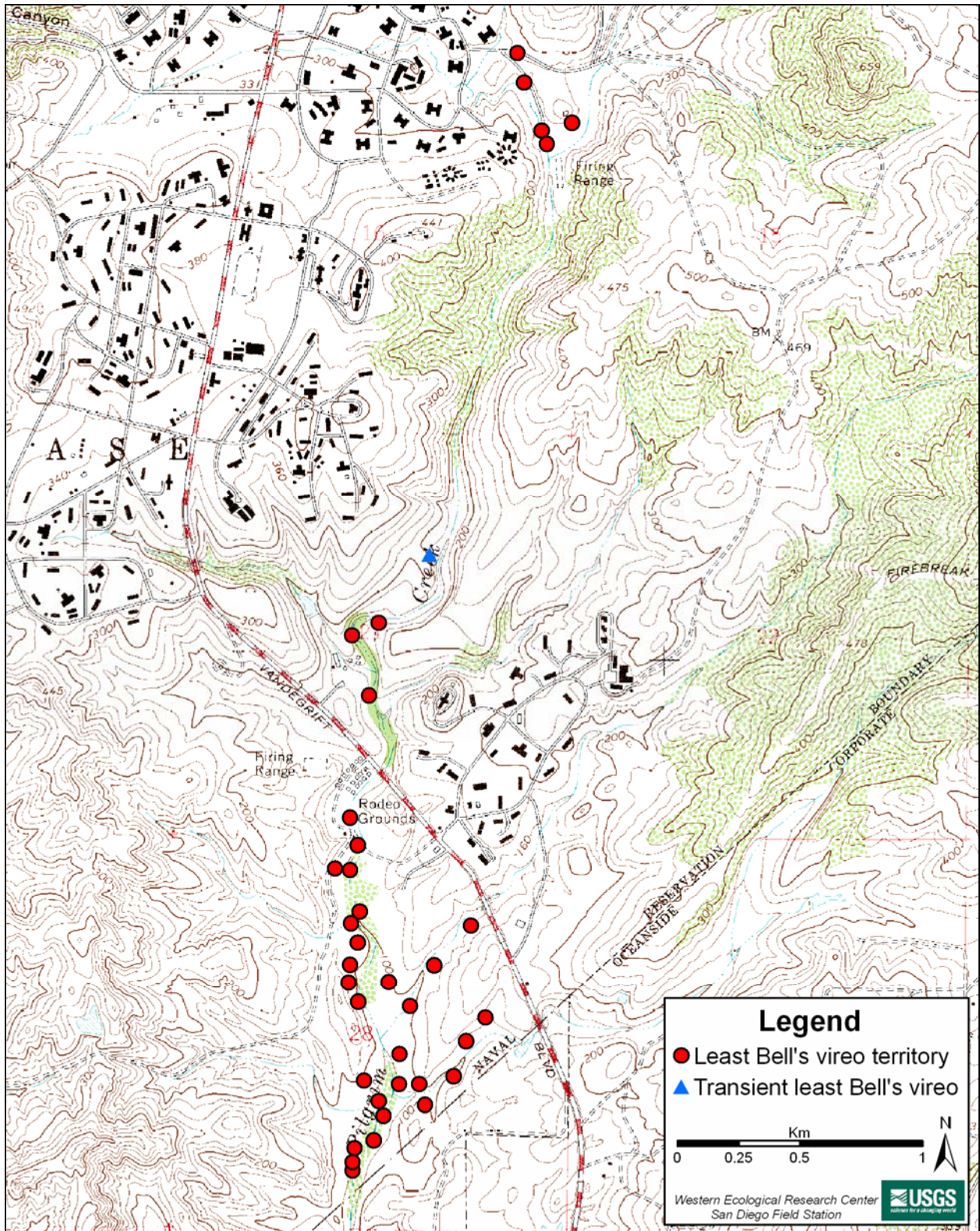


Figure 14. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower Pilgrim Creek.

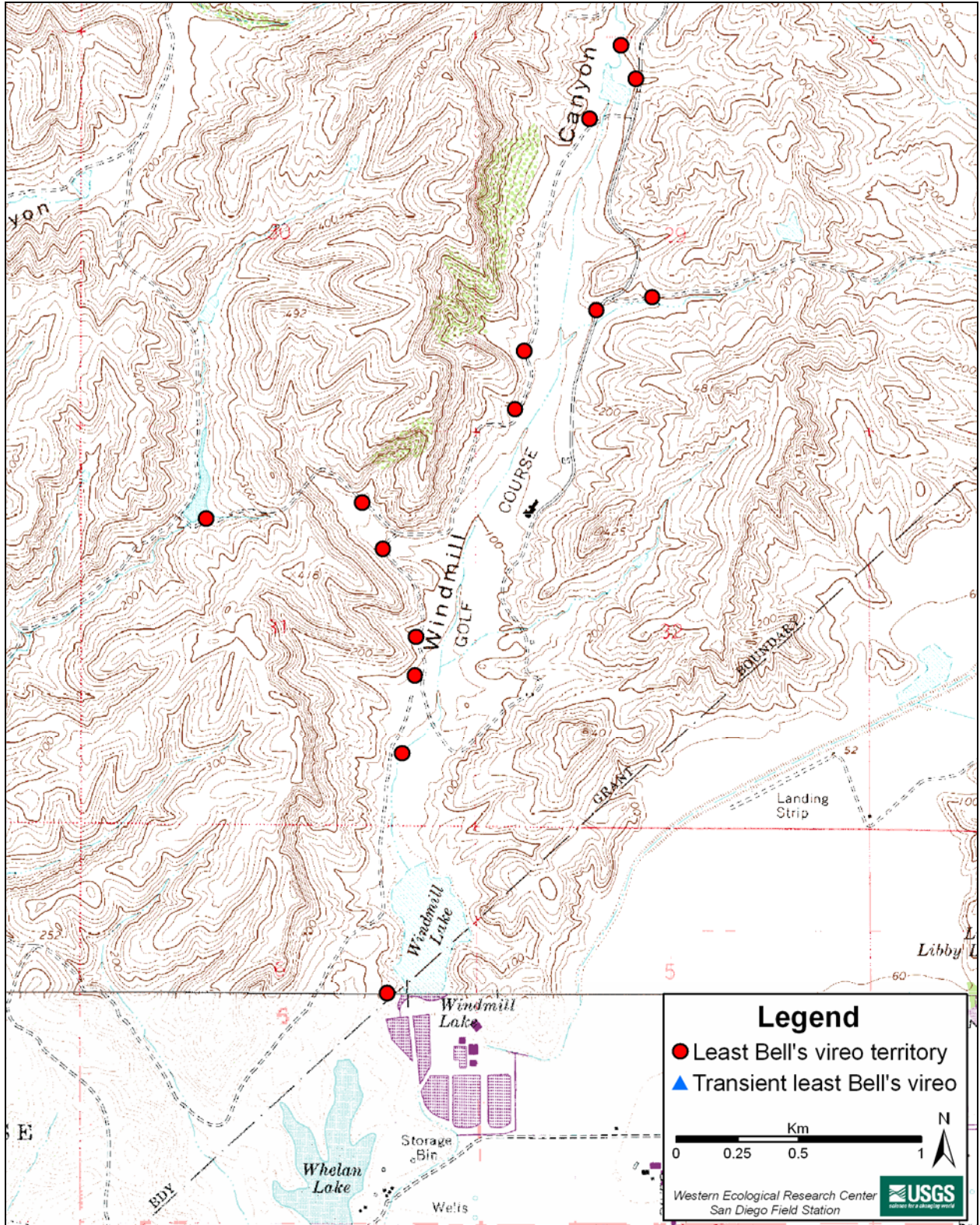


Figure 15. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Windmill Canyon and Ysidora Basin to Windmill Canyon.

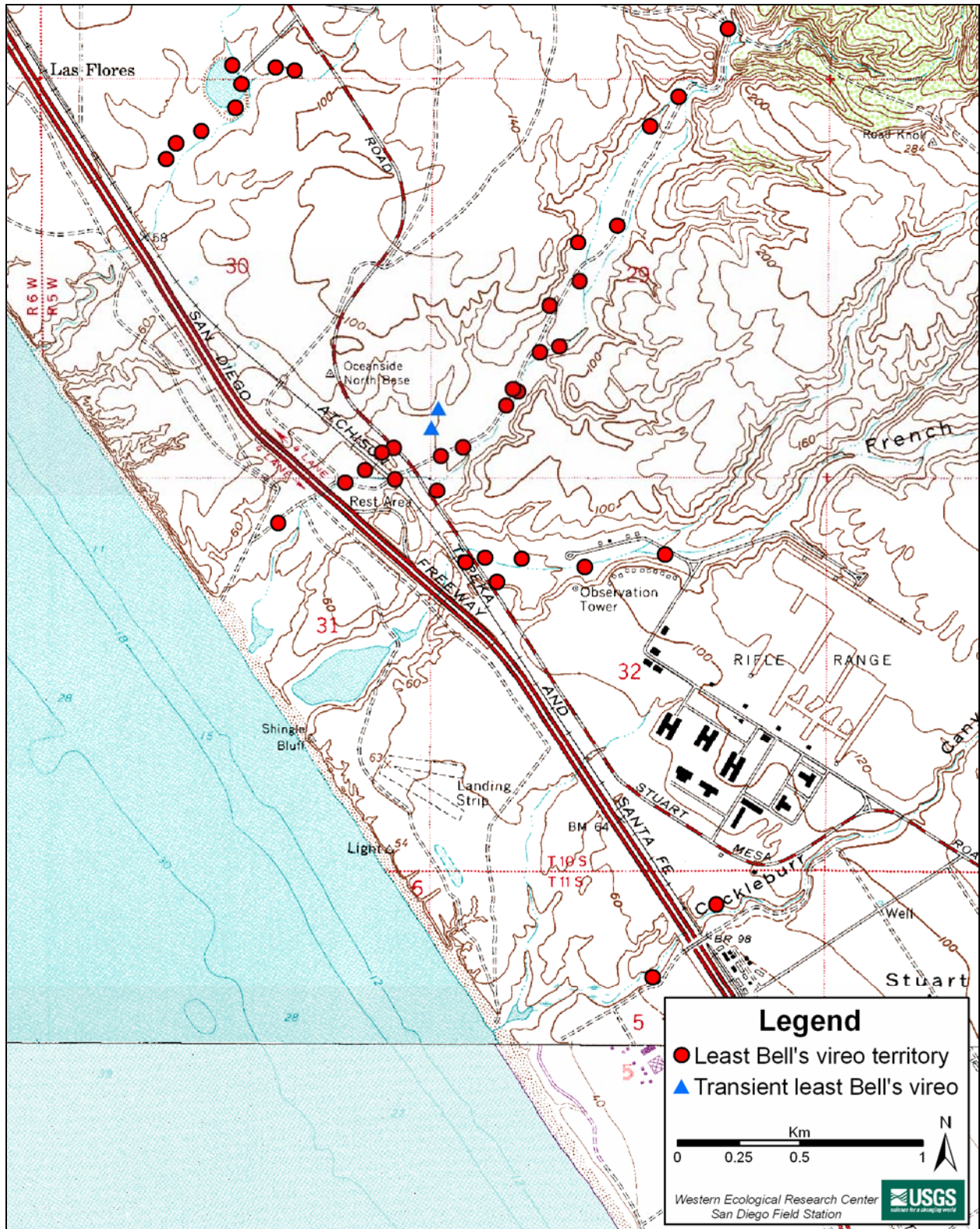


Figure 16. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Cockleburrr Canyon, French Creek, Aliso Creek, and Hidden Canyon.

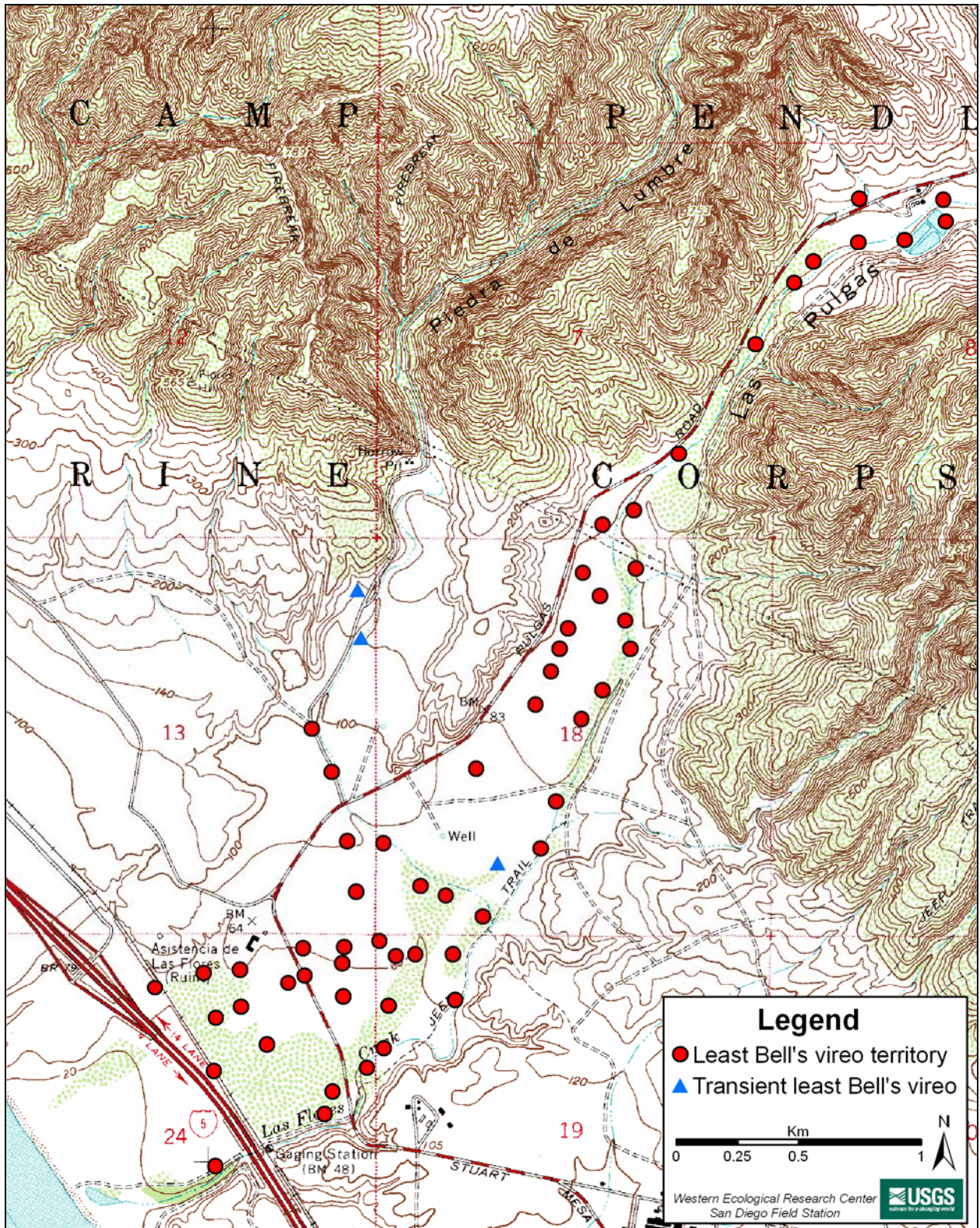


Figure 17. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower Las Flores Creek.

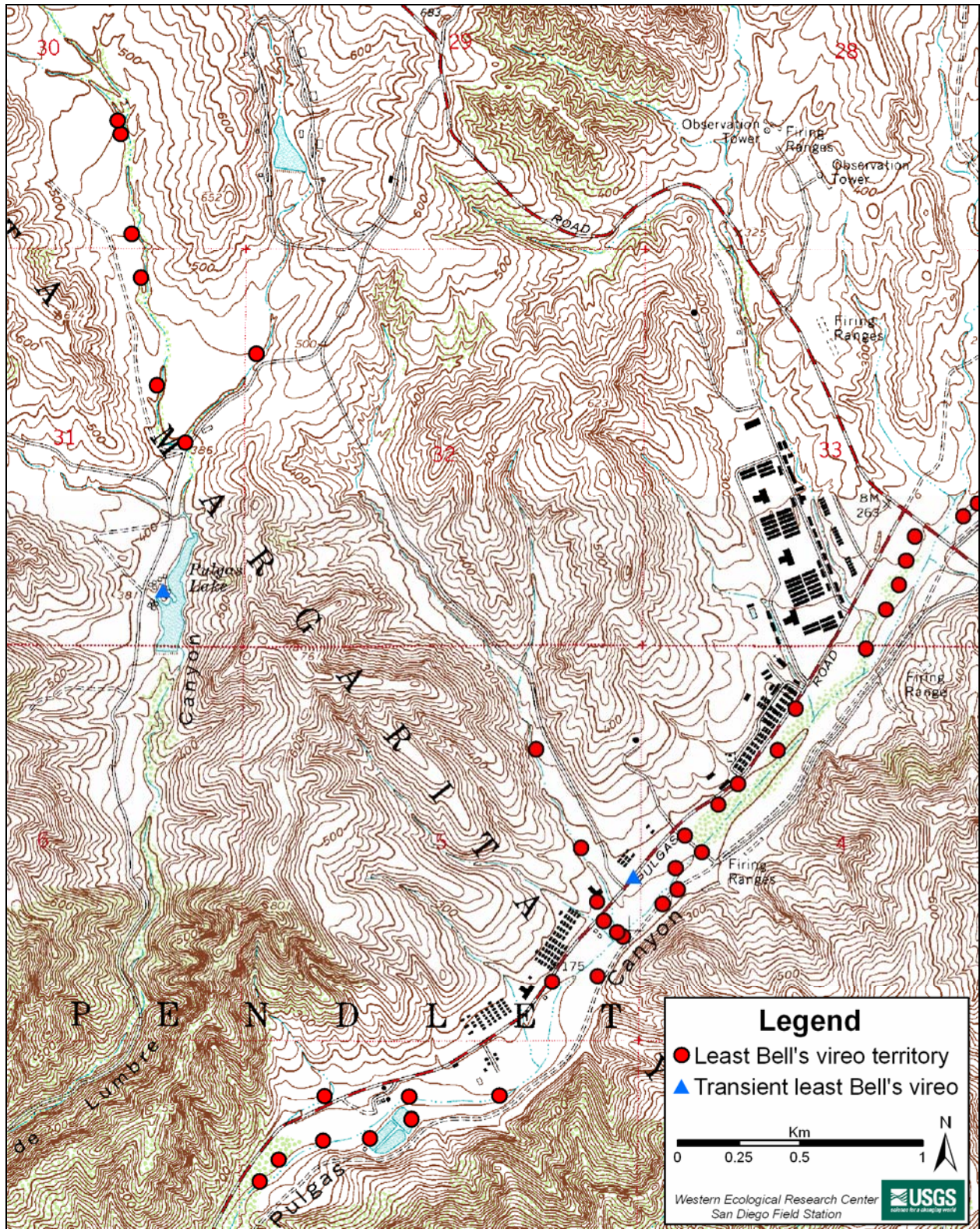


Figure 18. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Piedra de Lumbre Canyon and Las Flores Creek.

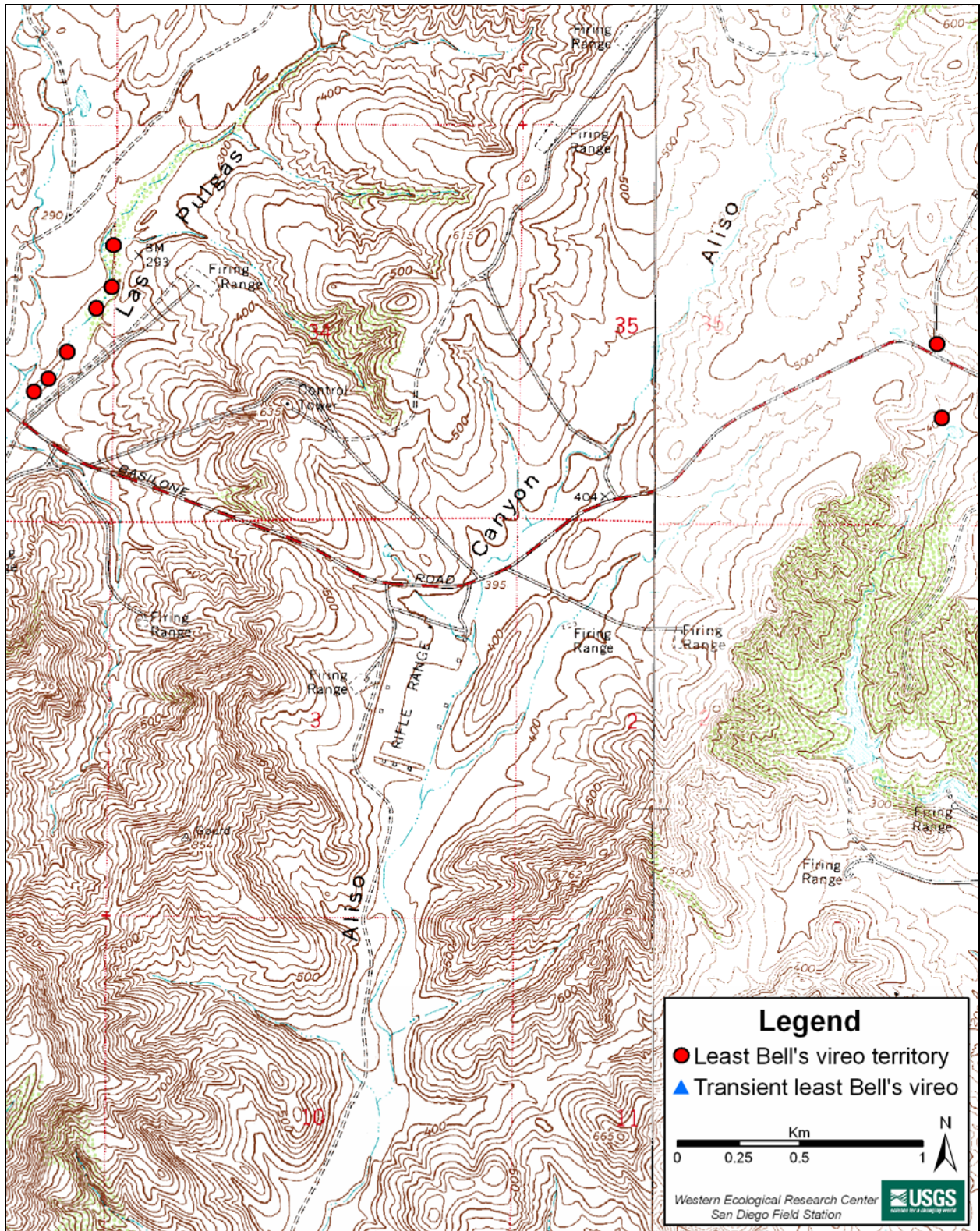


Figure 19. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper Las Flores Creek and Basilone and Roblar Roads.

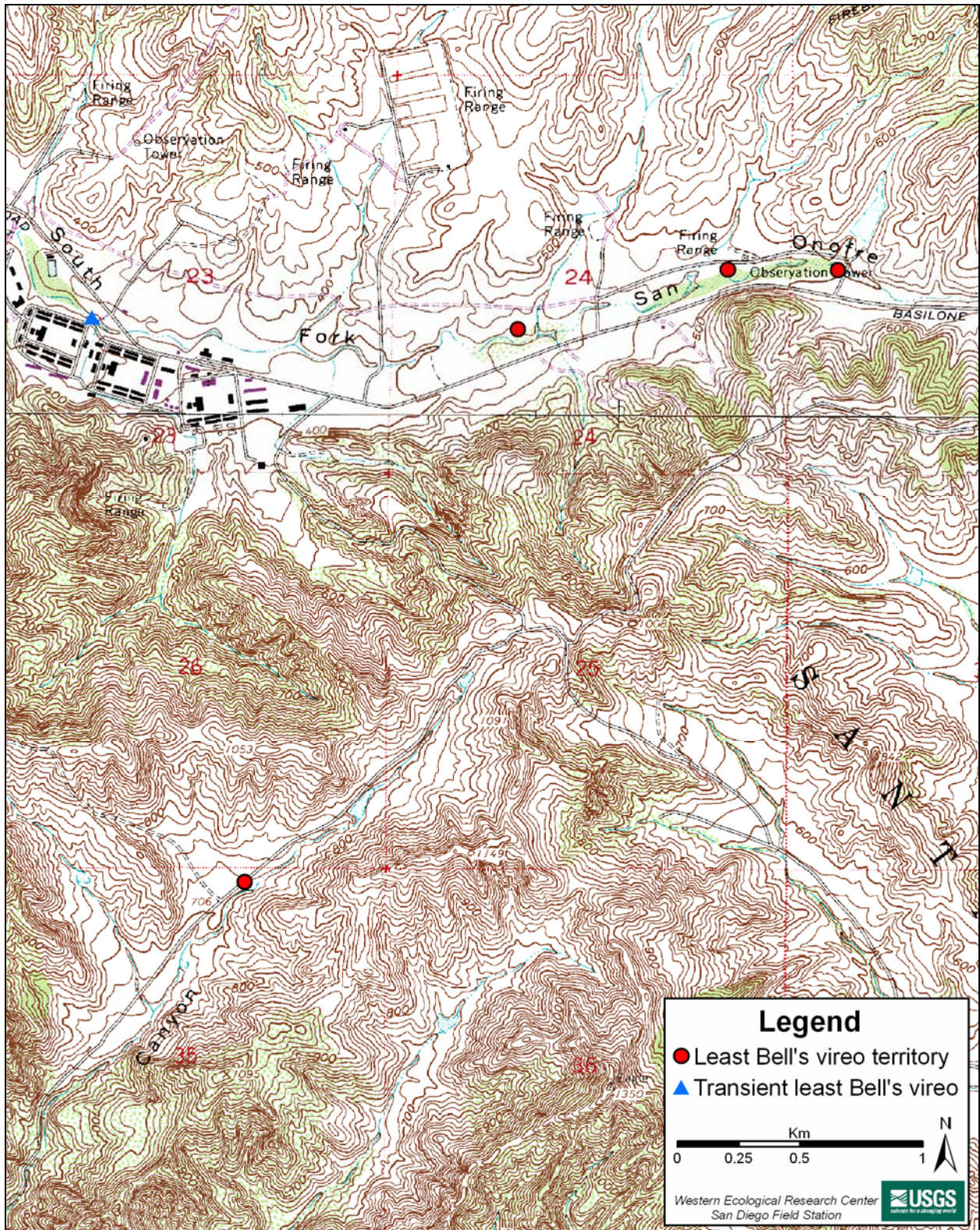


Figure 20. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper San Onofre Creek and Horno Canyon.

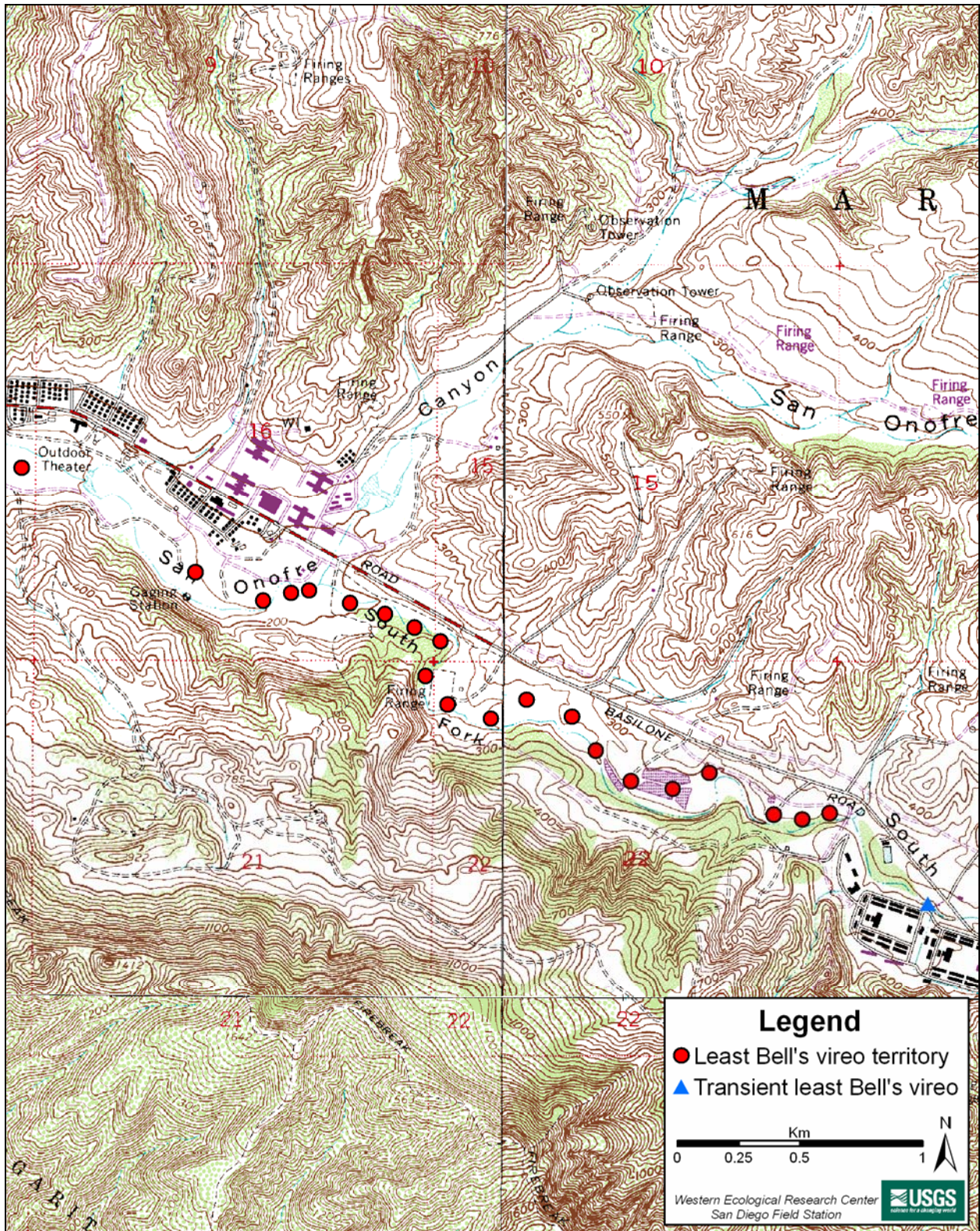


Figure 21. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek.

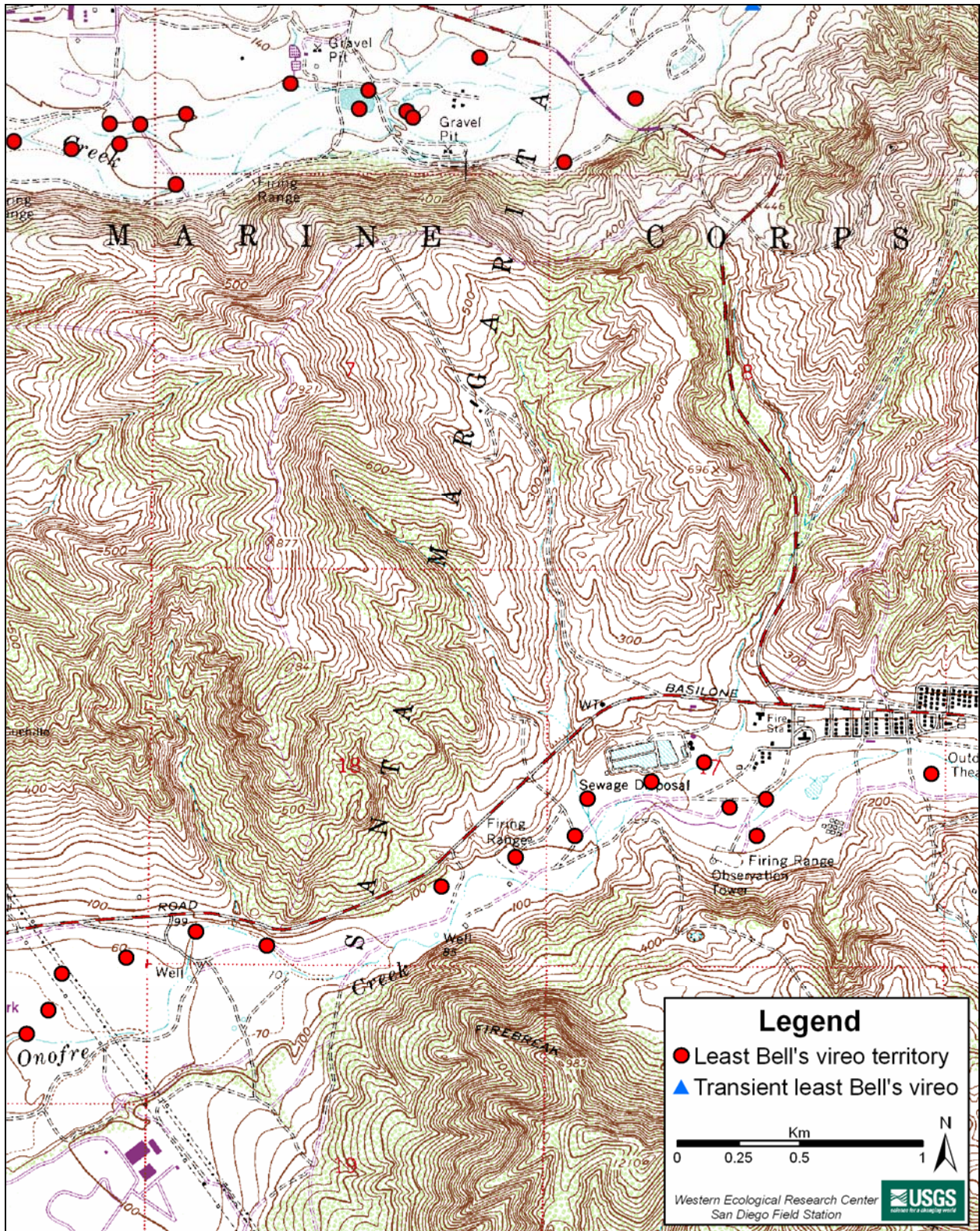


Figure 22. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Onofre Creek and San Mateo Creek.

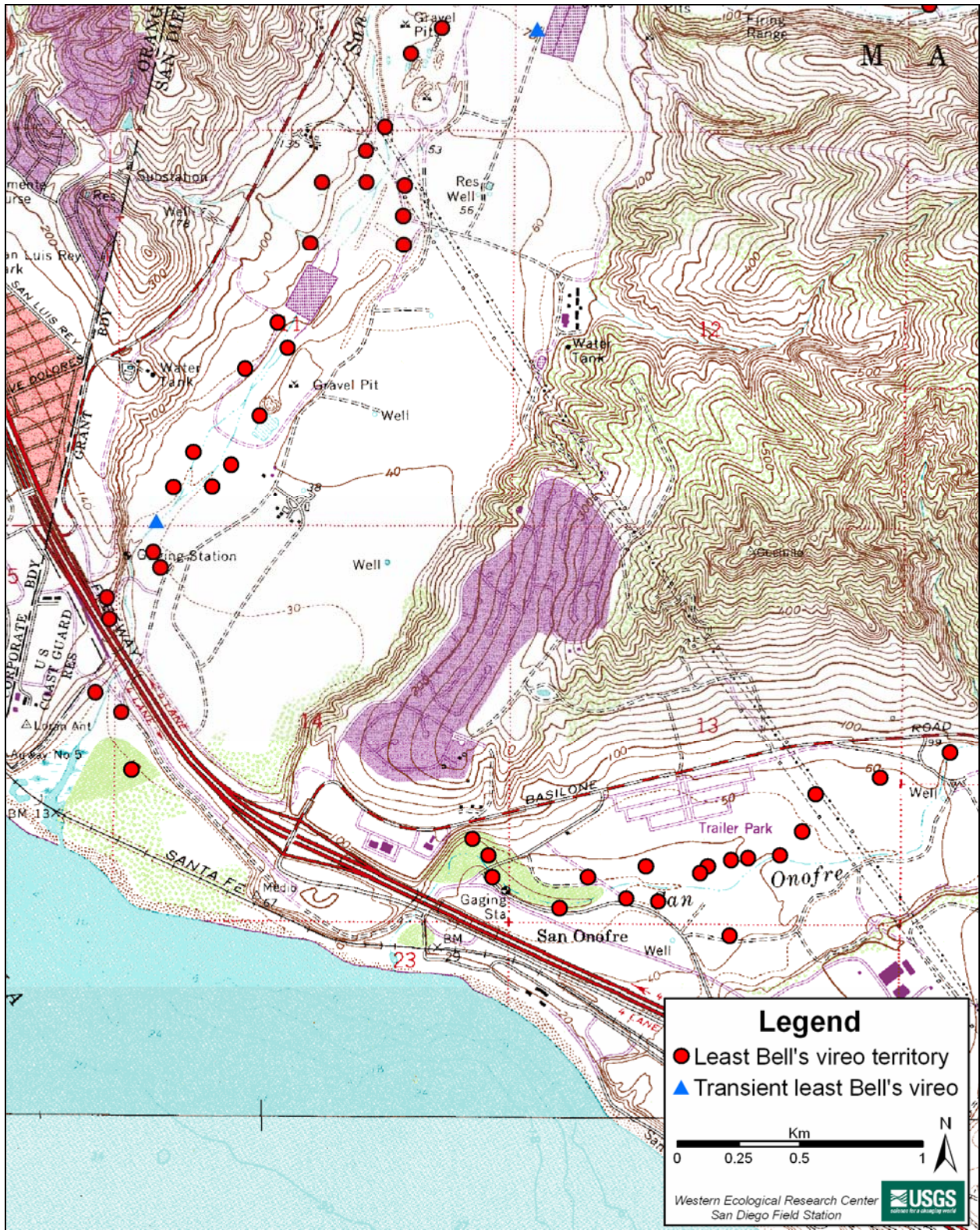


Figure 23. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Lower San Onofre Creek and Lower San Mateo Creek.

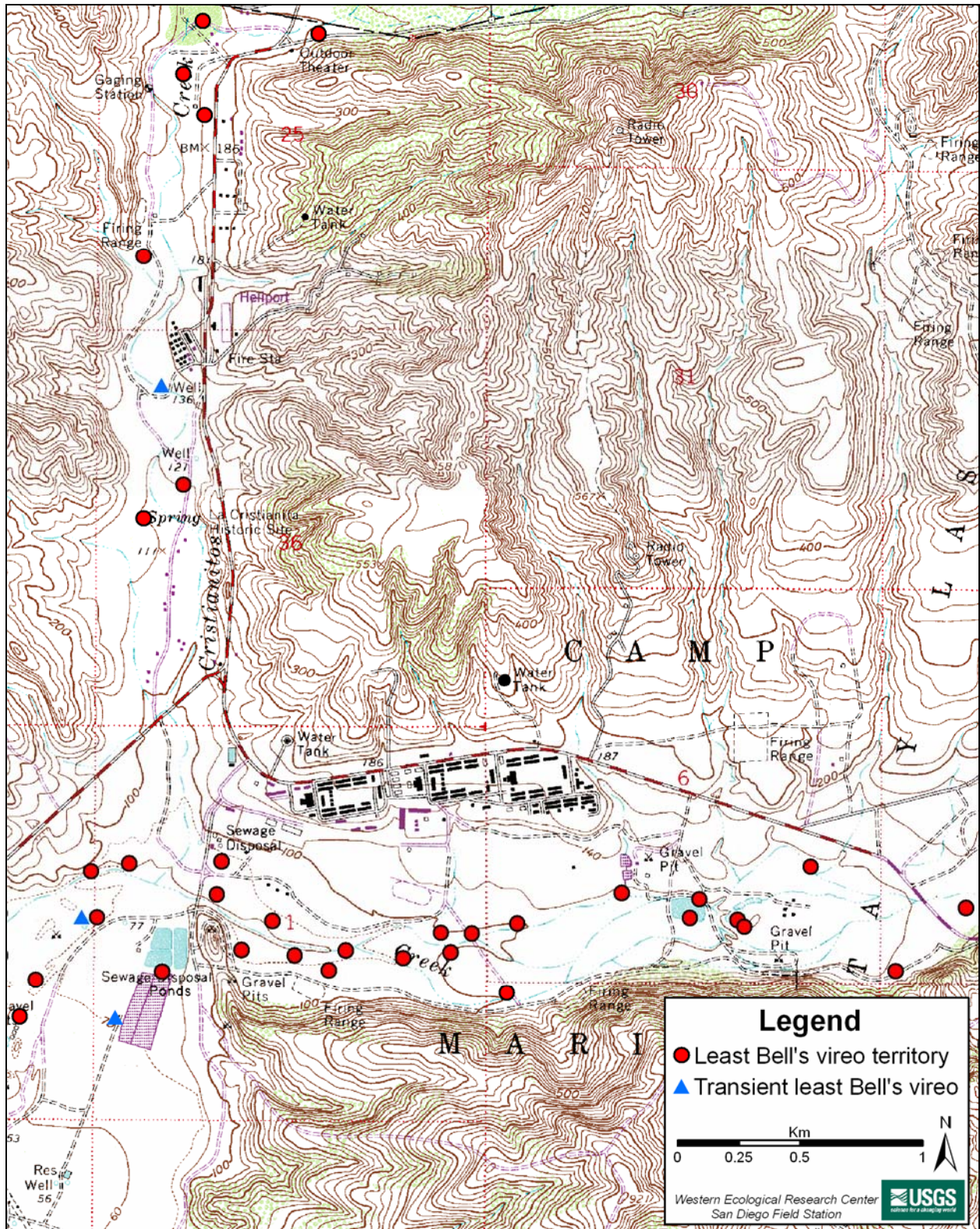


Figure 24. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: San Mateo Creek and Cristianitos Creek.

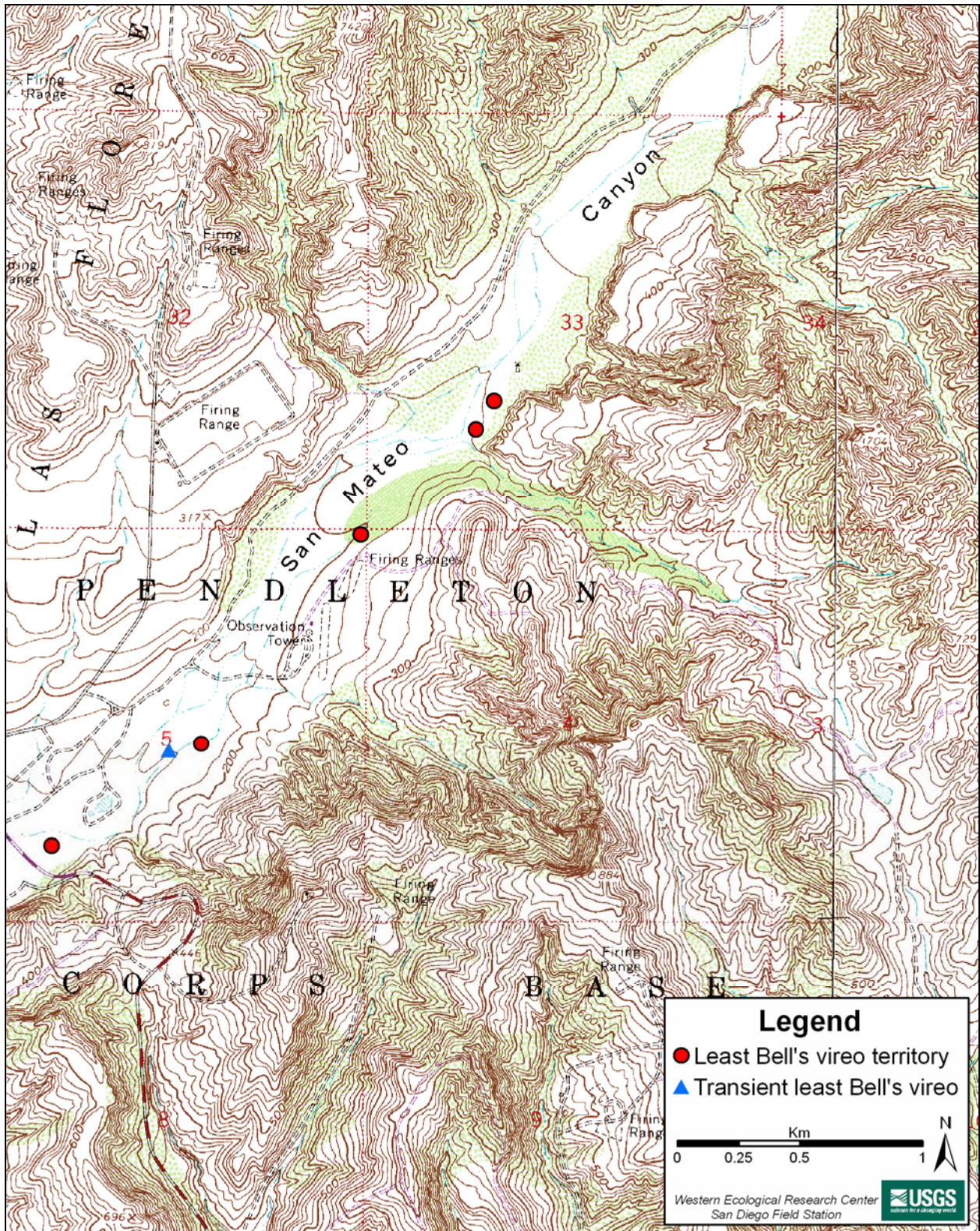


Figure 25. Locations of least Bell's vireo at Marine Corps Base Camp Pendleton, 2005: Upper San Mateo Creek.

Windmill Canyon), with the majority of vireo territories occurring along the Santa Margarita River, the largest expanse of riparian vegetation on Base (Tables 1, 2). The remaining fourteen drainages/sites each contained ten or fewer territories.

Least Bell's vireo numbers were remarkably similar to those from 2004 (Table 2). Of the nine most populated drainages, the Santa Margarita River showed the greatest numeric increase (32 territories), increasing by seven percent over the 2004 population. Lake O'Neill/Fallbrook Creek showed the greatest percent increase, 25 percent, increasing by four territories. The drainages with the largest percentage decrease in population size were Windmill Canyon and De Luz Creek, decreasing by 40 and 31 percent, respectively. The site with the largest numeric loss in vireo numbers was San Mateo Creek, losing 12 territories. Comparing sites that were surveyed in both 2004 and 2005, the vireo population remained virtually stable, increasing by eight territories or one percent.

Table 2. Number of territorial males at Camp Pendleton, by drainage, in 2004 and 2005.

Drainage	Number of Territorial Males		Percent Change
	2005 ^a	2004 ^b	
Santa Margarita River ^c	472	440	+7%
De Luz Creek	18	26	-31%
Roblar Creek	0	1	-100%
Lake O'Neill/Fallbrook Creek	20	16	+25%
Pueblitos Canyon	5	3	+67%
Newton Canyon	8	9	-11%
Cocklebur Creek	2	0	-
French Canyon	6	5	+20%
Aliso Creek	21	21	0%
Hidden Canyon	8	5	+60%
Las Flores Creek	85	84	+1%
Piedre de Lumbre Canyon	8	5	+60%
Horno Canyon	1	0	-
San Onofre Creek	52	56	-7%
San Mateo Creek	56	68	-18%
Cristianitos Creek	6	8	-25%
Talega Canyon	1	0	-
Pilgrim Creek	36	37	-3%
Windmill Canyon	12	20	-40%
Ysidora Basin to Windmill Canyon	4	8	-50%
De Luz Homes	4	5	-20%
Total	825	817	

^a 2005 sites not listed: Basilone-Roblar Roads (2 males); 2005 total = 827 territories.

^b 2004 sites not listed: Tuley Canyon (2 males), and Vandegrift Hills (1), Kilo 1/ Kilo 2 Hills (2); 2004 total = 822 territories

^c Includes vireo territories detected within the 22 Area.

Habitat Characteristics

Vireos used a number of different habitat types ranging from willow-dominated thickets along stream courses to upland vegetation along roads and channel margins (Table 3). The

majority of vireo territories occurred in habitat characterized as Willow Riparian, with 62 percent of the males in the study area found in this habitat. An additional eight percent of birds occupied willow habitat co-dominated by cottonwoods or sycamores. The second most commonly used habitat type, occupied by 19 percent of the population, was Riparian Scrub, dominated by *B. salicifolia* and/or *S. exigua*. Ten percent of the vireos used more upland habitats including areas dominated by a mix of sycamores and oaks (2 percent of total) or other upland vegetation (8 percent).

Table 3. Habitat types used by least Bell's vireos at Camp Pendleton, 2005.

Habitat Type	Number of Territories			Percent of Total
	>50% Native	>50% Exotic	Total^a	
Mixed Willow	462	50	512	62%
Willow/Cottonwood	7	0	7	1%
Willow/Sycamore	49	8	57	7%
Riparian Scrub	101	55	156	19%
Sycamore/Oak	11	3	14	2%
Upland Scrub	32	31	63	8%
Non-native	0	13	13	1%
Total	662	160	822	100%

^a Percent exotic vegetation was not measured in five territories.

Two percent of vireo territories (13/827; nine territories on the Santa Margarita River, three on San Mateo Creek, and one on San Onofre Creek) were placed in habitat vegetated almost entirely with non-native vegetation (Table 3), and an additional 147 territories (18 percent) were in areas where exotic species such as *A. donax*, *Conium maculatum*, *Brassica nigra*, and *Tamarix* spp. made up 50 percent or more of the habitat. Cover of exotic vegetation

Table 4. Number and proportion of least Bell's vireo territories dominated or co-dominated by exotic vegetation, by drainage.

Drainage	Territories dominated or co-dominated by exotics	
	Number	Proportion
Piedra de Lumbre Canyon	8	1.00
Horno Canyon	1	1.00
Windmill Canyon	8	0.67
San Mateo Creek	37	0.66
Newton Canyon	5	0.63
Cristianitos Creek	3	0.50
Ysidora Basin to Windmill Canyon	1	0.25
San Onofre Creek	12	0.23
Santa Margarita River	78	0.17
O'Neil Lake/Fallbrook Creek	3	0.15
De Luz Creek	1	0.06
Aliso Creek	1	0.05
Las Flores Creek	2	0.02
Total	160	

was greatest in Piedra de Lumbre Canyon, Windmill Canyon, San Mateo Creek, and Newton Canyon where more than half of all vireo territories were located in habitat dominated or co-dominated by exotic vegetation (Table 4).

Banded Birds

Fifteen least Bell's vireos banded prior to the 2005 breeding season were resighted on Base in 2005 (Table 5). Six were originally banded off Base on Pilgrim Creek (Kus *et al.* 2004) and one had been banded on the San Luis Rey River (Kus unpubl. data). One of the remaining eight vireos was recaptured and was determined to have been originally banded at the Santa Margarita River Monitoring Avian Productivity and Survivorship (MAPS) Station (Kus and Beck 1998). The remaining seven were not recaptured, but were most likely banded at the same MAPS station because of their proximity to the MAPS area. Adult birds of known age ranged from two to seven years old.

Table 5. Banded least Bell's vireos at Camp Pendleton, 2005.

Drainage	Band Combination ^a		Natal Site	Age ^b	Comments
	Sex	Left Leg			
<u>Pilgrim Creek</u>					
M	Mbk	YEYE	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek H1 Pink Flag territory. Target netted.
M	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted south of rodeo grounds.
F	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted south of rodeo grounds.
<u>Santa Margarita River</u>					
M	-	DGOR/Mgo	Santa Margarita River	7 yrs	Natal site Santa Margarita MAPS station. Msi band worn; rebanded with Mgo band. Target netted.
M	Mbk	WHWH	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek Inlet 3E territory. Target netted.
M	DPWH/Mbk	-	Pilgrim Creek - off Base	2 yrs	Natal site Pilgrim Creek Golf Course territory. Target netted.
F	Mbk	-	Pilgrim Creek - off Base	AHY	Resighted within Ysidora Basin.
F	Mdb	-	San Luis Rey River	AHY	Resighted adjacent to the Air Station.
F	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
F	-	Msi	?	AHY	Resighted north of the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted close to the Santa Margarita MAPS Station.
M	-	Msi	?	AHY	Resighted north of the Santa Margarita MAPS Station.
M	Msi	-	?	AHY	Resighted north of the Santa Margarita MAPS Station.

Table 5 (continued). Banded least Bell's vireos at Camp Pendleton, 2005.

Drainage	Band Combination ^a		Natal Site	Age ^b	Comments
	Sex	Left Leg			
F	ORPU/Mgo	-	?	AHY	Banded in 2005.
F	PUPU	Mgo	?	AHY	Banded in 2005.
F	WHWH/Mgo	-	?	AHY	Banded in 2005.
M	-	BK BK/Mgo	?	AHY	Banded in 2005.
M	-	LPLP/Mgo	?	AHY	Banded in 2005.
M	-	PUPU/Mgo	?	AHY	Banded in 2005.
M	BK BK	Mgo	?	AHY	Banded in 2005.
M	BK BK/Mgo	pupu	?	AHY	Banded in 2005.
M	BYST/Mgo	-	?	AHY	Banded in 2005.
M	DPWH/Mgo	pupu	?	AHY	Banded in 2005.
M	LPLP/Mgo	pupu	?	AHY	Banded in 2005.
M	Mgo	DGOR/pupu	?	AHY	Banded in 2005.
M	Mgo	DPWH/pupu	?	AHY	Banded in 2005.
M	Mgo	LPBK	?	AHY	Banded in 2005.
M	Mgo	LPBK/pupu	?	AHY	Banded in 2005.
M	Mgo	PUWH	?	AHY	Banded in 2005.
M	Mgo	PUWH/pupu	?	AHY	Banded in 2005.
M	Mgo	YEYE	?	AHY	Banded in 2005.
M	Mgo	YEYE/pupu	?	AHY	Banded in 2005.
M	OROR/Mgo	pupu	?	AHY	Banded in 2005.
M	ORPU/Msi	pupu	?	AHY	Banded in 2005.
M	PUPU/Mgo	pupu	?	AHY	Banded in 2005.
M	PUWH/Mgo	-	?	AHY	Banded in 2005.
M	PUWH/Mgo	pupu	?	AHY	Banded in 2005.
M	WHWH/Mgo	pupu	?	AHY	Banded in 2005.
M	YEPU/Mgo	-	?	AHY	Banded in 2005.
M	YEYE/Mgo	pupu	?	AHY	Banded in 2005.
U	-	LPBK/Mgo	?	AHY	Banded in 2005.
U	OROR/Msi	pupu	?	AHY	Banded in 2005.
U	Mgo	BK BK/pupu	?	AHY	Probable adult female. Banded 2005.
U	-	ORPU/Mgo	?	AHY	Banded in 2005.
U	BYST/Mgo	pupu	?	AHY	Banded in 2005.
U	DGOR/Mgo	pupu	?	AHY	Banded in 2005.
U	LPBK/Mgo	pupu	?	HY?	Possible hatch year bird, caught while target netting adult in territory.
U	-	OROR/Mgo	Santa Margarita	HY	Caught while target netting adult.
U	LPBK/Mgo	-	Santa Margarita	HY	Caught while target netting adult.
U	Mgo	ORPU	Santa Margarita	HY	Caught while target netting adult.
U	ORPU	Mgo	Santa Margarita	HY	Caught while target netting adult.
U	WHWH/pupu	Mgo	Santa Margarita	HY	Caught while target netting adult.

^a Band colors: MbK = black numbered federal band; Mdb = dark blue numbered federal band; Msi = silver numbered federal band; Mgo = gold numbered federal band; YEYE = plastic yellow; ORPU = plastic orange-purple split; PUPU = plastic purple; pupu = metal purple; WHWH = plastic white; BK BK = plastic black; DGOR = plastic dark green-orange split; BYST = plastic blue-yellow striped; DPWH = plastic dark pink-white split; LPLP = plastic light pink; LPBK = plastic light pink-black split; PUWH = plastic purple-white split; OROR = plastic orange; YEPU = plastic yellow-purple split.

^b Age: AHY = after hatch year, HY = hatch years.

A total of 134 least Bell's vireos were banded during the 2005 season. These included 36 adult vireos that were target netted and banded with a unique color combination, 96 hatch-year birds, 91 of which were banded as nestlings with a single gold numbered federal band and five that were incidentally caught while attempting to target net an adult vireo in a territory, and two vireos of undetermined age.

Nest Monitoring

Nesting activity was monitored in a total of 62 territories within the Giant Reed Removal and Reference monitoring areas (Table 6, Figures 26-29, Appendix 1). Of these, 35 territories were "fully" monitored, indicating that all nests within the territory were found and documented during the breeding season. Pairs within the remaining 27 territories were documented nesting; however, only a subset of nests by a pair were found and monitored. A total of 98 nests were monitored during the breeding season, 66 of which came from fully monitored territories. Within fully monitored territories, pairs in the Reference and Removal sites each averaged 1.9 nesting attempts over the course of the 2005 breeding season. One Removal pair was documented building on two occasions, but never completed either nest.

Table 6. Number of least Bell's vireo territories and nests monitored, Camp Pendleton, 2005.

	<u>Nest Monitoring Area Type</u>	
	<u>Reference</u>	<u>Removal</u>
Territories fully monitored	15	20
Nests in fully monitored territories	29	37
Completed nests per pair (fully monitored territories)	1.9	1.9
Total # of nests monitored	55	43

Fully monitored pairs at Reference and Removal sites were equally likely to re-nest after their initial attempt as 71 percent of pairs at Reference sites attempted a second nest, compared to 68 percent of pairs at Removal sites ($\chi^2_{0.05,1} = 2.69, P = 0.10$). Nest fate influenced the likelihood that pairs would re-nest. One hundred percent of Reference and Removal pairs whose initial nests failed attempted second nests, compared to only 33 percent of Reference and 14 percent of Removal pairs re-nesting after a successful first attempt. During the course of the 2005 breeding season 93 percent of Reference pairs and 85 percent of Removal pairs fledged young. Five Reference and three Removal pairs initiated three nesting attempts, and only a single Removal pair initiated four nesting attempts in 2005.

Nest success of pairs breeding in Reference sites did not differ appreciably from those at removal sites, as 45 percent (25/55) of Reference nests and 47 percent (20/43) of Removal nests successfully fledged young. Causes of nest failure were similar between Reference and Removal sites. Predation was believed to be the primary source of nest failure at both sites, although no predation events were witnessed (Table 7). Predation accounted for 77 (23/30) and 87 (20/23) percent of nest failures at Reference and Removal sites, respectively. Overall, 42 and 46 percent, respectively, of completed vireo nests were lost to predation. No nests were directly lost to parasitism; however two instances of possible brown-headed cowbird nest predation were

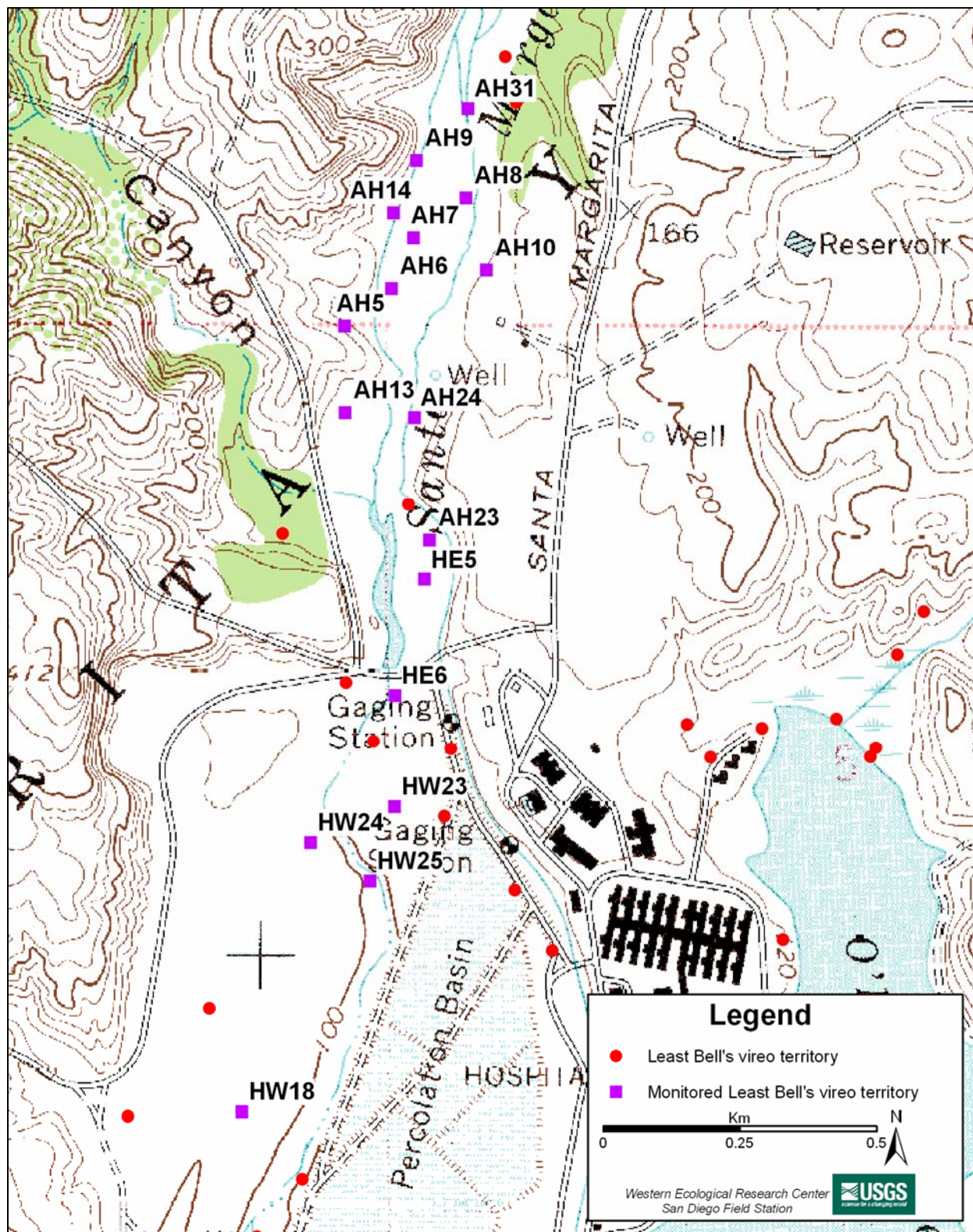


Figure 26. Locations of monitored least Bell's vireo territories at the Above Hospital reference site, Marine Corps Base Camp Pendleton, 2005.

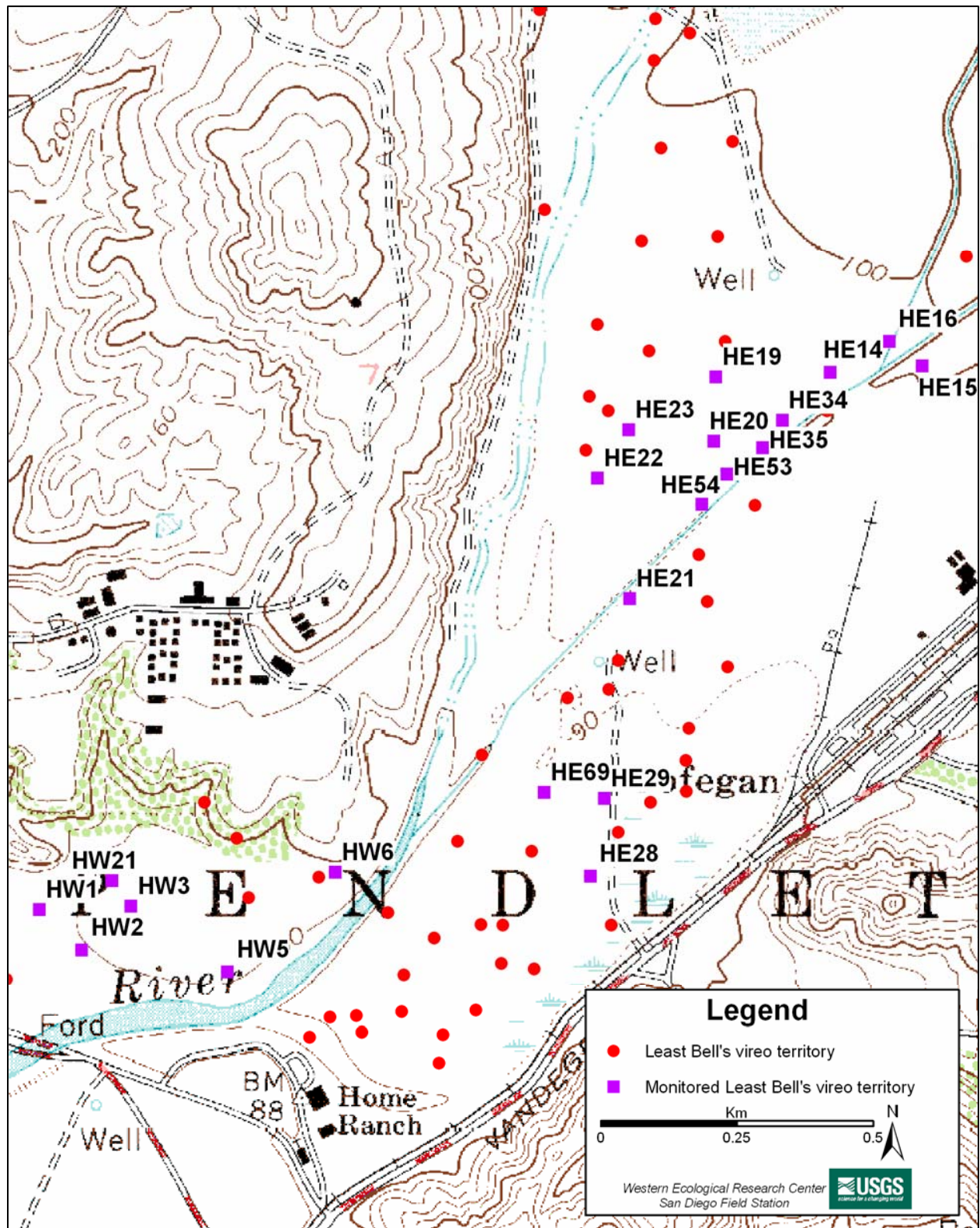


Figure 27. Locations of monitored least Bell's vireo territories at the Below Hospital reference site, Marine Corps Base Camp Pendleton, 2005.

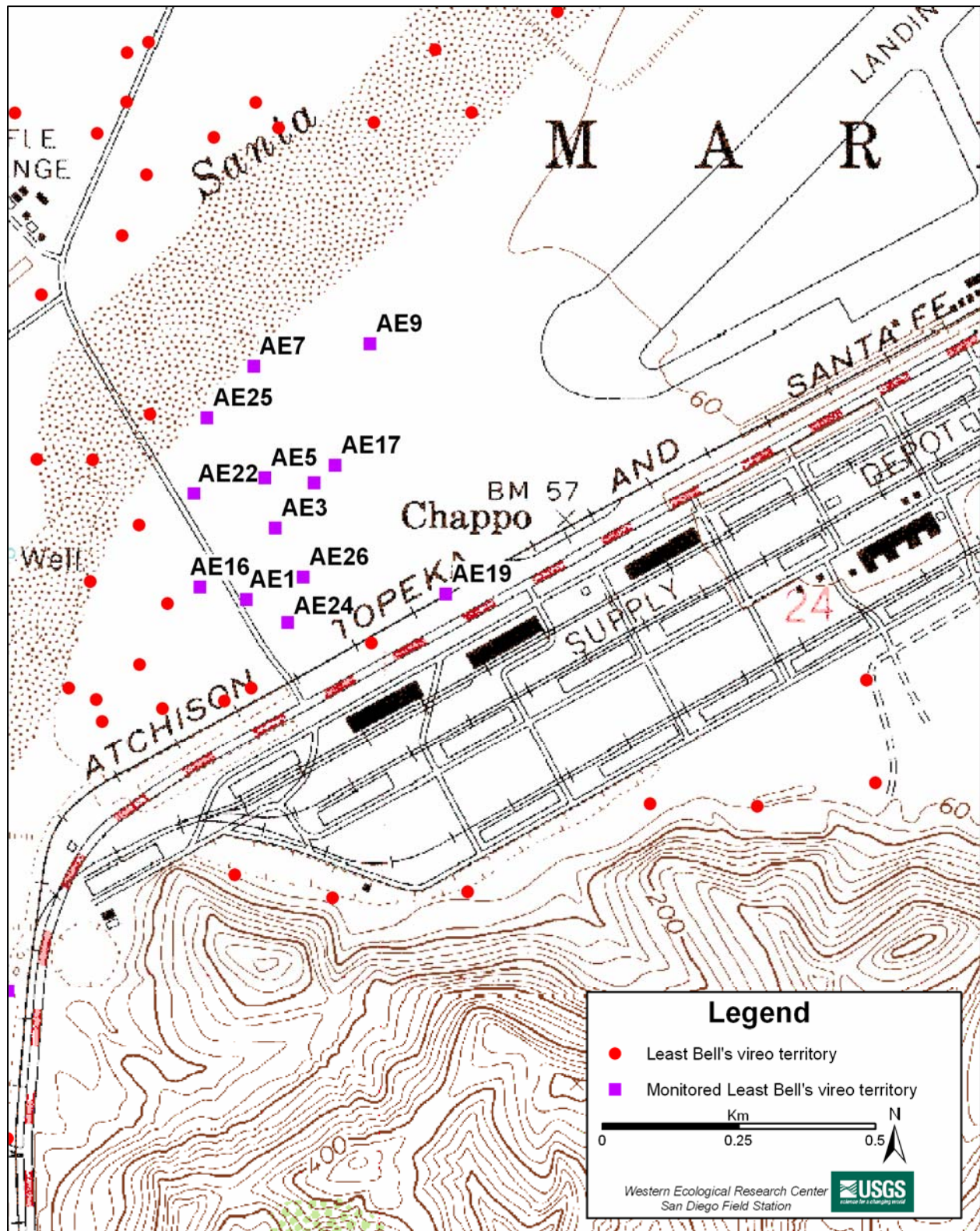


Figure 28. Locations of monitored least Bell's vireo territories at the Air Station giant reed removal site, Marine Corps Base Camp Pendleton, 2005.

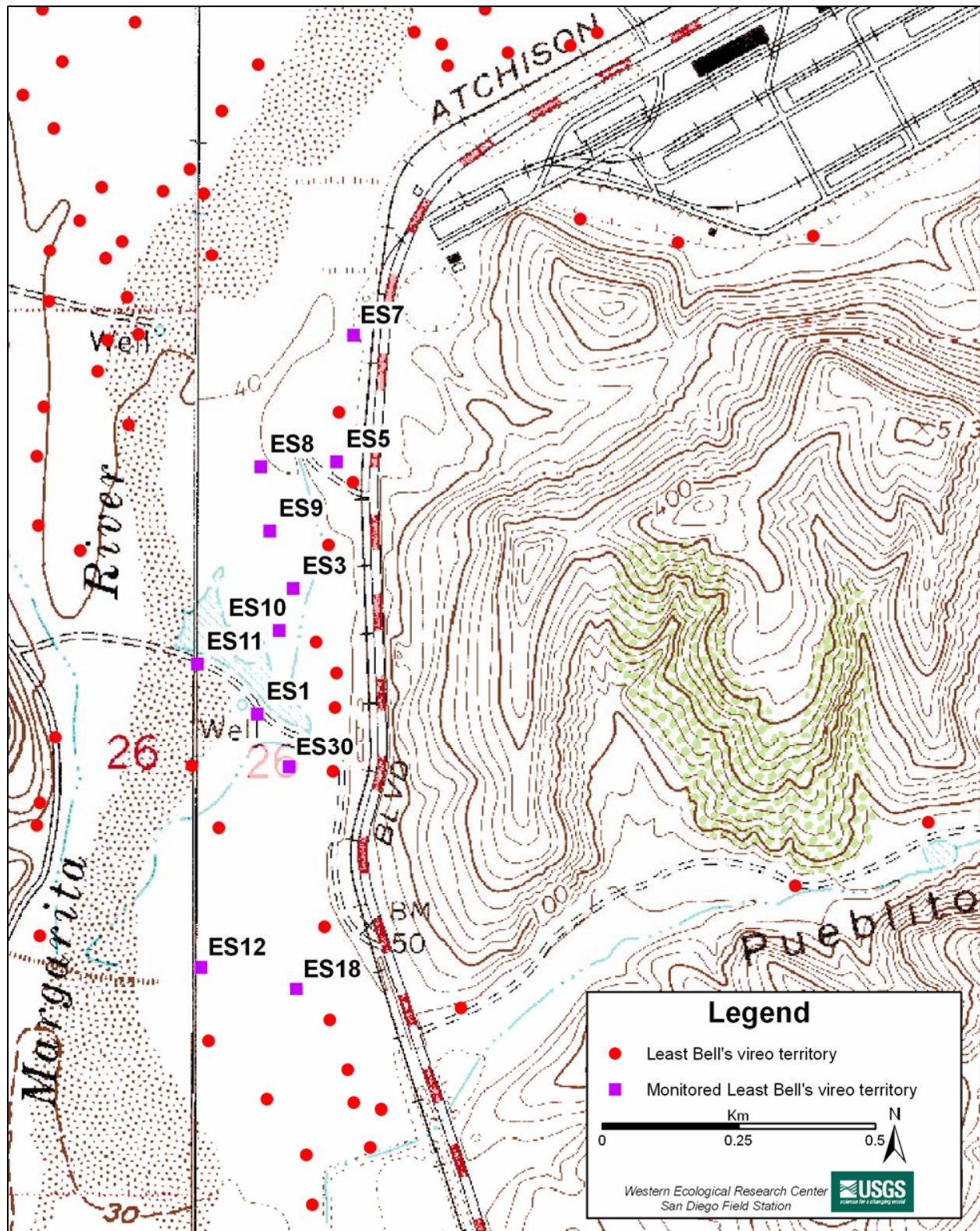


Figure 29. Locations of monitored least Bell's vireo territories at the Seep giant reed removal site, Marine Corps Base Camp Pendleton, 2005.

documented. One monitored nest was found with a punctured egg, and two eggs from a second nest were found on the ground with punctures, but were not consumed. An additional source of nest failure was linked to the use of the exotic plant *C. maculatum* as a nesting substrate by Bell's vireos. Thirty-three percent (3/9) of the nests built in *C. maculatum* failed when the branch supporting the nest, or the entire nest substrate, collapsed dumping the eggs and/or young on the ground. Nest substrate failure also caused the loss of one nest built in *S. lasiolepis* when the branch supporting the nest gave out. Finally, the cause of failure of four nests was unknown. It is possible that they could have been depredated in the egg stage or abandoned prior to egg laying, as they failed during the time eggs should have been laid and no eggs were observed in the nest.

Table 7. Cause of failure of least Bell's vireo nests, Camp Pendleton, 2005.

Cause of Failure	Number of Nests		
	Reference	Removal	Total
Predation	23	20	43
Parasitism	0	0	0
Other/Unknown	7	3	10
Total Completed Nests	55	43	98

Productivity

Productivity of least Bell's vireos nesting at the Reference and Removal sites differed in some aspects (Table 8), but overall productivity measures were very similar. For example, although nesting vireos at Removal sites exhibited a higher hatching rate (67% vs. 58%; percent of all eggs that hatched) and had higher hatching success (70 % vs. 59%, percent of nests with one or more hatchlings), average clutch size, average brood size, and the average number of young fledged per pair were not statistically different. A large proportion of vireos at both sites were successful in fledgling young from at least one nest as 93 percent (14/15) of Reference pairs and 85 percent (17/20) of Removal pairs within fully monitored territories fledged young.

Table 8. Reproductive success and productivity of nesting least Bell's vireos at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

Parameter	Total Number	
	Reference	Removal
Nests with eggs	49	37
Eggs laid	156	120
Average clutch size ^a	3.7 ± 0.6 (std)	3.6 ± 0.6 (std)
Nests with hatchlings	29	26
Hatchlings	87	80
Average brood size ^b	3.1 ± 1.0 (std)	3.2 ± 0.6 (std)
Hatching success:		
Eggs ^c	58%	67%
Nests ^d	59%	70%
Nests with fledglings	23	20
Fledglings ^e	66	56
Fledgling success:		
Hatchlings ^f	76%	70%
Nests ^g	79%	77%
Fledglings per nest	1.2	1.3
Average number of young fledged per pair ^h	2.8 ± 1.3 (std)	2.5 ± 1.3 (std)
Pairs fledgling ≥ one young ⁱ	14 (93%)	17 (85%)

^a Based on 31 Reference and 27 Removal non-parasitized nests with a full clutch. (Two-sample *t*-test: $t_{0.05, 55} = 2.00$, $P = 0.43$).

^b Based on 22 Reference and 17 Removal non-parasitized nests known to have a full brood. (Two-sample *t*-test: $t_{0.05, 37} = 2.03$, $P = 0.89$).

^c Percent of all eggs that hatched.

^d Percent of all nests with eggs in which at least one egg hatched.

^e Excludes two Reference nests that were not found, but fledgling(s) were detected.

^f Percent of all nestlings that fledged.

^g Percent of all nests with nestlings in which at least one young fledged.

^h Based on 15 Reference and 20 Removal pairs who were monitored fully, two of which did not nest. (Two-sample *t*-test: $t_{0.05, 33} = 2.03$, $P = 0.43$).

ⁱ Based on pairs whose territories were monitored fully.

Nest Characteristics

Successful and unsuccessful nests within Reference and Removal sites 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 9). However, differences in nest placement were observed between nests built within Reference and Giant Reed Removal sites. Vireo nests at Removal sites were placed significantly higher above ground than nests at Reference sites (Table 9), which corresponded with an average higher host plant height. Although only marginally significant, nests at Removal sites were placed roughly 30 percent deeper within hosts than nests at Reference sites.

Table 9. Least Bell's vireo nest characteristics and results of two-sample unequal variance t-tests of successful vs. unsuccessful nesting attempts at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

Nest Characteristic	Nest Fate		df ^a	t ^b	P ^c
	Successful	Unsuccessful			
Reference Site					
Average nest height (m)	0.65	0.71	46	-1.03	0.31
Average host height (m)	2.58	2.83	50	-0.51	0.61
Average distance to edge of host (m)	0.46	0.48	44	-0.12	0.91
Removal Site					
Average nest height (m)	0.91	0.92	30	-0.10	0.92
Average host height (m)	2.96	3.67	37	-1.33	0.19
Average distance to edge of host (m)	0.85	0.55	23	1.44	0.16
	Overall	Reference	Removal		
Average nest height (m)	0.68	0.92	67	-4.42	< 0.0001
Average host height (m)	2.71	3.32	88	-1.64	0.10
Average distance to edge of host (m)	0.47	0.69	59	-1.83	0.07

^a df = degrees of freedom (sample size – 1)

^b t = two-sample unequal variance t-test test statistic

^c P = P-value (the probability of observing a test statistic as extreme as, or more extreme than the one observed).

Vireos at Reference and Removal sites were comparable in their selection of host species, with 60-74 percent of nests placed in *S. lasiolepis*, *B. salicifolia* and *S. exigua* (Table 10). Vireos at the Removal sites placed proportionately fewer nests in *B. salicifolia* and proportionately more in *S. lasiolepis* than did birds at the Reference sites, probably a reflection of the relative availability of those species at each site. An additional nine plant species and one dead plant were used as nest support by vireos, including three herbaceous exotic species. Fourteen percent of all nests were placed in two of the exotic species, *C. maculatum* and *B. nigra*, reflecting the disturbed nature of many of the nest sites.

Table 10. Host plant species used by least Bell's vireos at Reference and Giant Reed Removal sites, Camp Pendleton, 2005.

Host Species ^a	Reference			Removal		
	Successful	Unsuccessful	Total ^b	Successful	Unsuccessful	Total ^b
<i>Baccharis salicifolia</i>	6	4	10 (0.19)	1	1	2 (0.05)
<i>Salix lasiolepis</i>	5	11	16 (0.31)	9	14	23 (0.53)
<i>Brassica nigra</i>	3	1	4 (0.08)	1	0	1 (0.02)
<i>Rosa californica</i>	2	0	2 (0.04)	0	0	0 (0.00)
<i>S. exigua</i>	2	3	5 (0.10)	5	2	7 (0.16)
<i>Toxicodendron</i> spp.	2	0	2 (0.04)	0	1	1 (0.02)
<i>Vitis californica</i>	2	2	4 (0.08)	1	0	1 (0.02)
<i>Conium maculatum</i>	1	3	4 (0.08)	1	4	5 (0.12)
<i>Erechtites</i> spp.	1	0	1 (0.02)	0	0	0 (0.00)
<i>Salix goodingii</i>	0	0	0 (0.00)	1	1	2 (0.05)
<i>Sambucus mexicana</i>	0	1	1 (0.02)	1	0	1 (0.02)
<i>Artemisia californica</i>	0	2	2 (0.04)	0	0	0 (0.00)
Dead	0	1	1 (0.02)	0	0	0 (0.00)

^a The host species for one nest within a Reference site was not recorded.

^b Numbers in parentheses are proportions of total nests.

DISCUSSION

Data indicate a possible vireo carrying capacity on Marine Corps Base Camp Pendleton between 700 and 1000 territories which is most likely influenced by the annual variability in a number of biotic and abiotic factors, such as changes in precipitation, temperature, and prey availability. Over the past 11 years, the vireo population on Base has fluctuated between a low of 696 territories in 1995 to a high of 1011 territories in 1998 (Griffith Wildlife Biology 2004). From 1998 to 2003 the vireo population steadily declined to 718 territories. In 2004, the population increased to 823 territories, and has appeared to stabilize. Least Bell's vireo abundance in 2005 on Base was very similar to the 2004 estimate as it differed by only eight territories (825 territories in 2005 vs. 817 in 2004) when sites surveyed in both years were compared.

The primary difference between the 2004 and 2005 vireo populations was not in abundance but in the slight change in distribution of birds on Base. For example, in 2005 the population on De Luz Creek decreased by 31 percent (8 territories), while San Mateo Creek decreased by 18 percent (12 territories). In contrast, the Lake O'Neill/Fallbrook Creek site increased by 25 percent (4 territories) and the population on the Santa Margarita River increase by 7 percent, or 32 territories. This redistribution of vireos is probably a reflection of the heavy winter rains and spring flooding that scoured numerous drainages, altering or removing suitable vireo habitat and causing birds to vacate previously occupied areas and settle in novel sites on other drainages. The scouring caused by spring flooding most likely reduced the amount of high quality habitat within many rivers as vireos were documented nesting in "atypical" habitats dominated by such species as black mustard (*B. nigra*), poison hemlock (*C. maculatum*) and thistle (*Cirsium* spp.), or in areas set back from the main river channel. We were not able to definitively document the redistribution and dispersal of vireos between drainages as few birds

were banded prior to the 2005 breeding season. Continued color banding initiated in 2005 to investigate dispersal on and off Base will provide a better understanding of vireo habitat use in dynamic riparian systems.

Nest success and productivity were similar between Giant Reed Removal and Reference nest monitoring sites. Predation was the primary cause of nest failure in Reference and Removal sites, accounting for 42-46 percent of all nest losses. Productivity at both sites was high, with vireos fledging more than two young per pair. Average clutch size, average brood size, and the average number of young fledged per vireo pair in Reference and Removal sites did not differ statistically, indicating no apparent difference in productivity between vireos nesting in Reference and Giant Reed Removal sites in 2005. From these results it appears that in the short term vireos, nesting in Giant Reed Removal sites were not adversely affected by removal operations. However, 2005 was an extremely wet year and these results may be atypical. Winter/spring rains fostered the growth of herbaceous plants forming dense vegetation patches, and subsequently comprising large portions of many vireo territories. Only through continued monitoring will we determine if vireo productivity in Reference and Giant Reed Removal sites will remain similar in years experiencing more typical levels of precipitation.

The prevalence of exotic vegetation on Base was widespread and is a potential issue of concern since its impact(s) on least Bell's vireo abundance and distribution is not well known. The use of exotics by least Bell's vireos was extensive, with 15 percent of all monitored nests built in exotic plants and approximately 33 percent of nests built in poison hemlock failing when the host plant gave way. Exotic plants were a dominant component of at least one vireo territory within all drainages containing vireos and were also a dominant component of approximately 20 percent of all vireo territories Base-wide. Currently, Camp Pendleton has implemented programs to remove the exotics giant reed and perennial pepperweed (*Lepidium latifolium*) from riparian systems. However, it is only through continued nest monitoring that we will be able to answer the question whether particular exotic species adversely affect least Bell's vireo nest success, productivity, and ultimately species recovery.

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APPENDIX 1

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Reference Site Territories					
Territory	Nest	Monitoring ^a	Nest Fate ^b	# Fledged	Comments
AH5	1	F	PRE	0	
	2		PRE	0	
	3		SUC	3	
AH6	1	F	PRE	0	
	2		SUC	1	
AH7	2		OTH	0	Substrate failure. Nest built in <i>S. lasiolepis</i>
	1	F	SUC	3	
AH8	1	F	PRE	0	
	2		SUC	4	
AH9	1	F	SUC	1	
AH10	1	F	SUC	3	
AH13	-	F	-	-	Pair did not nest
AH14	1	F	SUC	3	
	2		PRE	0	
AH23	1	F	UND	0	Cause of failure unknown
	2		PRE	0	
	3		SUC	3	
AH24	1	P	SUC	4	
AH31	1	P	PRE	0	
	2		PRE	0	
HE5	1	P	UND	0	Cause of failure unknown
HE6	1	P	SUC	3	
HE14	1	F	UND	0	Possible brown-headed cowbird predation, egg punctured
	2		UND	0	Possible brown-headed cowbird predation, two eggs on ground and punctured
	3		SUC	3	
HE15	1	F	PRE	0	
	2		PRE	0	
	3		SUC	4	
HE16	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
HE19	1	P	SUC	1	
HE20	1	P	OTH	0	Substrate failure. Nest built in <i>C. maculatum</i>
	2		SUC	-	Nest not found. Adults observed feeding 1 fledging.

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Reference Site Territories					
Territory	Nest	Monitoring ^a	Nest Fate ^b	# Fledged	Comments
HE21	1	P	SUC	-	Nest not monitored. Adults observed feeding 1 fledging.
HE22	1	P	SUC	2	
HE23	1	P	SUC	2	
HE28	1	F	SUC	4	
HE29	1	P	UND	0	Cause of failure unknown
HE34	1	P	PRE	0	
HE35	1	P	PRE	0	
HE53	1	P	PRE	0	
HE54	1	P	PRE	0	
	2		PRE	0	
HE69	1	P	SUC	3	
HW1	1	P	PRE	0	
HW2	1	F	PRE	0	
	2		SUC	4	
HW3	1	P	PRE	0	
HW5	1	F	SUC	4	
HW6	1	P	INC	0	Nest building was initiated, but the nest was never completed.
	2		PRE	0	
HW18	1	P	SUC	2	
HW21	1	P	PRE	0	
HW23	1	P	SUC	3	
HW24	1	P	SUC	4	
HW25	1	P	PRE	0	
Giant Reed Removal Site Territories					
AE1	1	F	OTH	0	Substrate failure. Nest built in <i>C. maculatum</i> .
	2		SUC	3	
AE3	1	F	PRE	0	
	2		SUC	2	
AE5	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
AE7	1	F	SUC	3	
AE9	1	F	PRE	0	
	2		SUC	3	
AE16	1	F	PRE	0	
	2		PRE	0	
AE17	1	F	SUC	3	
AE19	1	F	SUC	2	
AE22	1	F	PRE	0	
	2		SUC	4	

Status and nesting activities of least Bell's vireos at Marine Corps Base, Camp Pendleton, 2005.

Giant Reed Removal Site Territories					
Territory	Nest	Monitoring ^a	Nest Fate ^b	# Fledged	Comments
AE23	1	F	SUC	3	
AE24	1	F	PRE	0	
	2		PRE	0	
	3		SUC	2	
AE25	1	F	PRE	0	
	2		SUC	2	
AE26	1	F	OTH	0	Substrate failure. Nest built in <i>C. maculatum</i> .
	2		PRE	0	
	3		SUC	3	
ES1	1	F	INC	0	Nest building was initiated, but the nest was never completed.
	2		INC	0	Nest building was initiated, but the nest was never completed.
ES3	1	F	PRE	0	
	2		SUC	3	
ES5	1	F	SUC	4	
ES7	1	P	SUC	3	
ES8	1	F	SUC	3	
	2		SUC	1	
ES9	1	F	PRE	0	
	2		PRE	0	
	3		PRE	0	
	4		PRE	0	
ES10	1	F	PRE	0	
	2		SUC	4	
ES11	1	F	SUC	2	
ES12	1	P	PRE	0	
	2		PRE	0	
ES18	1	P	PRE	0	
	2		UND	0	Cause of failure unknown
ES30	1	P	SUC	4	

^a Monitoring: F = fully monitored territory; P = partially monitored territory

^b Nest Fate: Nest fate: INC = nest never completed; OTH = reason for nest failure known, such as substrate failure; PAR = failure/abandonment caused by brown-headed cowbird parasitism event; PRE = nest failure caused by predation event; SUC = fledged at least one least Bell's vireo young; UND = reason for nest failure/abandonment unknown.