



09 July 2009

SJP-TQ367-2087

Ms. Shannon Collis  
AFFTC/EM  
5 East Popson Avenue, Bldg. 2650A  
Edwards AFB, CA 93524-1130

Subject: Final 2008 Inventory of Presence of Mohave Ground Squirrels, Edwards Air Force Base,  
California

Reference: GSA Contract No. GS-10F-0268K, SIN 899, W91238-07-F-0067, Task Order Q367

Dear Ms. Collis:

Please find for as attached four paper copies and one copy as a pdf file on disk of the subject deliverable.  
Do not hesitate to contact me with any questions.

Sincerely,  
TETRA TECH, INC.

A handwritten signature in blue ink that reads 'Stephanie Pacheco'.

Stephanie Pacheco  
Principal Soil Scientist

Garcia, J, U.S. Army Corps of Engineers-one paper copy and one electronic copy  
Clark, D., Tetra Tech-one pdf copy via e-mail

Tetra Tech, Inc.

348 West Hospitality Lane, Suite 100, San Bernardino, CA 92408-3214

Tel 909.381.1674 Fax 909.889.1391 [www.tetratech.com](http://www.tetratech.com)

**AIR FORCE FLIGHT TEST CENTER/EMXC  
5 EAST POPSON AVENUE, BUILDING 2650A  
EDWARDS AIR FORCE BASE, CALIFORNIA**

**AND**

**U.S. ARMY CORPS OF ENGINEERS  
1325 J STREET  
SACRAMENTO, CALIFORNIA 93814-2922**



**INVENTORY OF PRESENCE OF  
MOJAVE GROUND SQUIRRELS  
EDWARDS AIR FORCE BASE, CALIFORNIA**



**FINAL**

**July 2009**

INVENTORY OF PRESENCE OF MOHAVE GROUND SQUIRRELS  
EDWARDS AIR FORCE BASE, CALIFORNIA  
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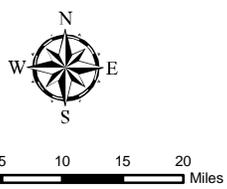
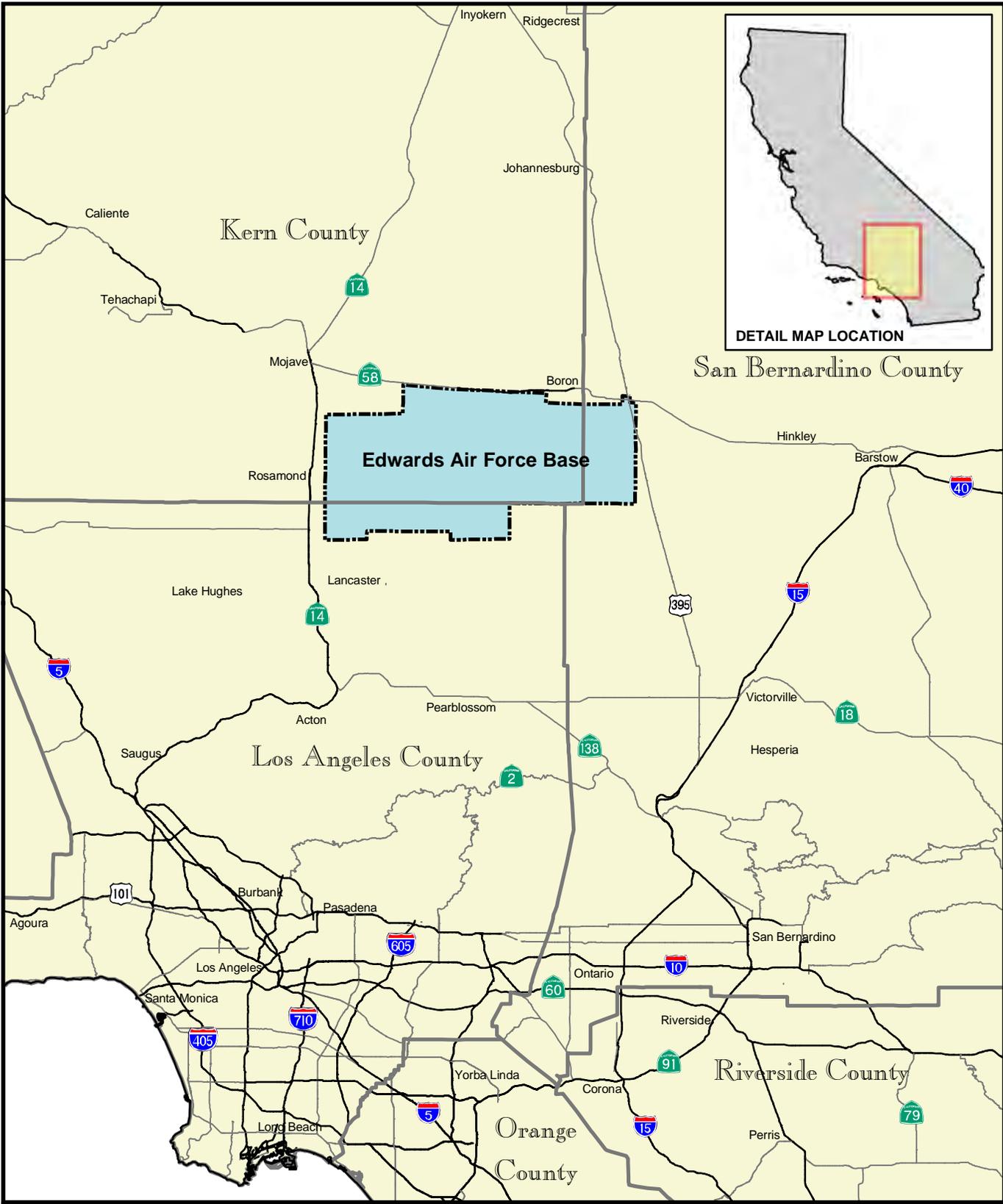
## 1.0 INTRODUCTION

Edwards Air Force Base (AFB) is located in Kern, Los Angeles, and San Bernardino counties, approximately 100 miles north of the city of Los Angeles (Figure 1). The base consists of approximately 307,792 acres (481 square miles) of largely undeveloped or semi-improved land that is used predominantly for aircraft test ranges and maintained and unmaintained landing sites (i.e., dry lake beds). The base is bounded by State Highways 14 to the west, 58 to the north, and 395 to the east, with county road Avenue E near the southern boundary of the base.

The developed portion of the base includes approximately six percent of the total base area and is concentrated on the west side of Rogers Dry Lake and includes North Base, South Base, Main Base, and Family Housing areas. In addition, the Air Force Research Lab (AFRL), formerly Phillips Laboratory, situated near and along Leumann Ridge in the eastern portion of the base includes a small developed area primarily used for administration, engineering, and testing related to rocket and propellant research.

Elevations on the base range from approximately 692 to 1,038 meters (2,270 to 3,404 feet) above mean sea level (amsl) with the lowest elevations found in the two major dry lakebeds, Rogers and Rosamond Dry Lakes. Higher elevation areas are found along ridges in the Rosamond and Bissel Hills in the northwest area of the base, along Leumann Ridge in the northeast, and Haystack Butte in the southeast.

The Mohave ground squirrel (*Spermophilus mohavense*) is a threatened species in the state of California. Mohave ground squirrels (MGS) are approximately 21.6 to 22.9 centimeters (8.5 to 9.0 inches) in length and can be found in desert scrub habitats. Activity periods for this species vary and little is known about their reproduction (Ingles 1979). Their diet consists of seeds, vegetative parts of desert plants including fruits of the Joshua tree. Due to the aridity and high temperatures of its environment they are a diurnal species spending up to seven months underground. The MGS is listed as threatened by California Department of Fish and Game Commission.



**Figure 1**  
**Location of**  
**Edwards Air Force Base, California**

## **2.0 PURPOSE**

The purpose of these surveys was to continue to collect data for MGS presence or absence at randomly selected transect locations on Edwards AFB.

## **3.0 OBJECTIVE**

The survey objective is to continue studies at random transects throughout Edwards AFB over many years to attempt to track the presence and absence trends of MGS on the base.

## 4.0 METHODOLOGY

Surveys were conducted according to the following recommended guidelines with the modification of each grid being trapped for only one session and no trapping conducted after 31 May 2008. All transect locations are shown on Figure 2.

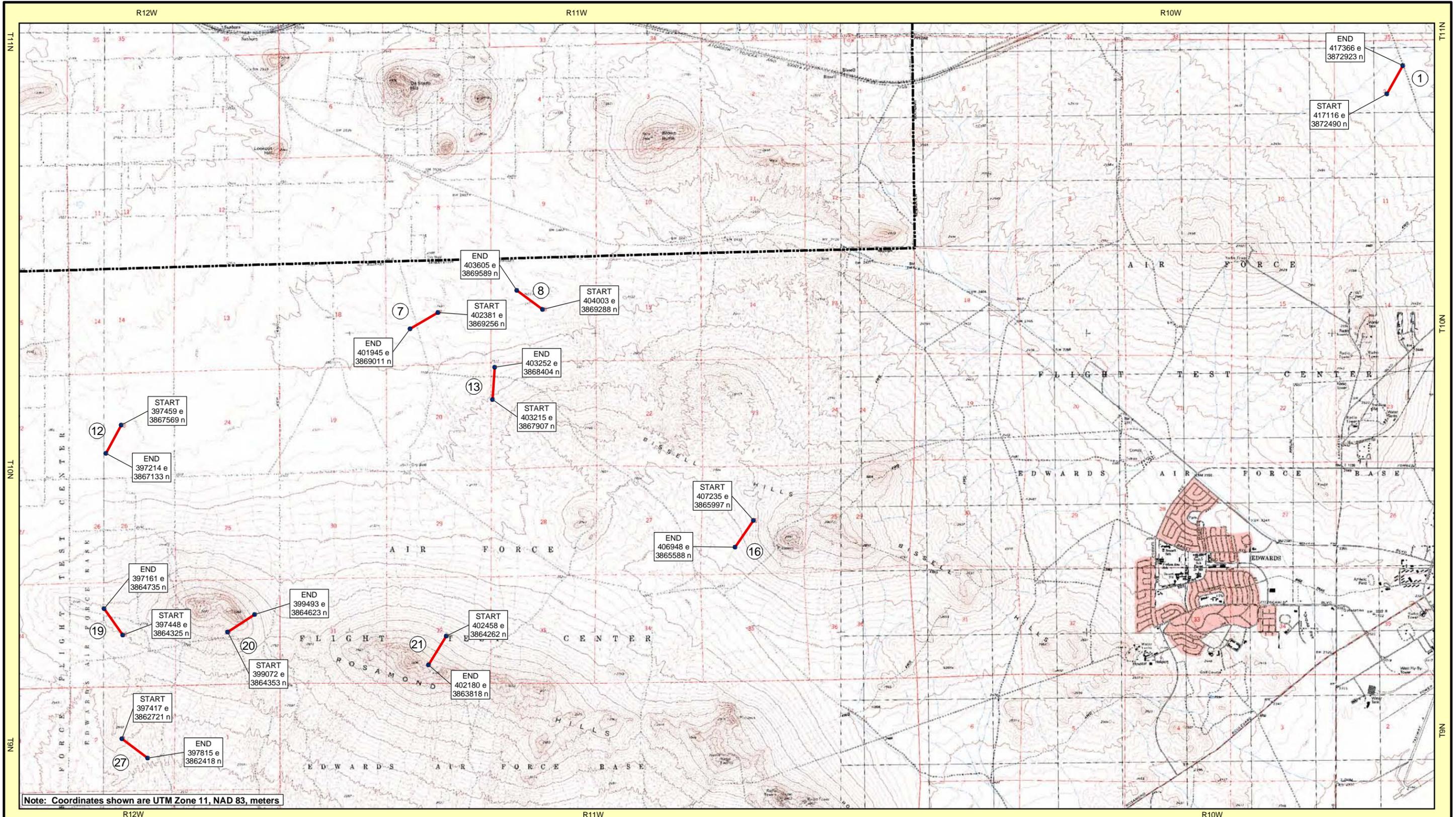
CALIFORNIA DEPARTMENT OF FISH AND GAME  
MOHAVE GROUND SQUIRREL SURVEY GUIDELINES  
(January 2003)

1. Visual surveys to determine Mohave ground squirrel activity and habitat quality shall be undertaken the period of 15 March through 15 April. All potential habitat on a project site shall be visually surveyed during daylight hours by a biologist who can readily identify the Mohave ground squirrel and the white-tailed antelope squirrel (*Ammospermophilus leucurus*).
2. If visual surveys do not reveal presence of the Mohave ground squirrel on the project site, standard small-mammal trapping grids shall be established in potential Mohave ground squirrel habitat. The number of grids will depend on the amount of potential habitat on the project site, as determined by the guidelines presented in paragraphs 4 and 5 of these guidelines.
3. For linear projects (for example, highways, pipelines, or electric transmission lines), each sampling grid shall consist of 100 Sherman live-traps (or equivalent; the minimum length of any trap is 12 inches) arranged in a rectangular pattern, 4 traps wide by 25 traps long, with traps spaced 35 meters apart along each of the four trap lines. At a minimum, one sampling grid of this type shall be established in each linear mile, or fraction thereof, of potential Mohave ground squirrel habitat along the project corridor.
4. For all other types of projects, one sampling grid consisting of 100 Sherman live-traps (or equivalent; the minimum length of any trap is 12 inches) shall be established for each 80 acres, or fraction thereof, of potential Mohave ground squirrel habitat on the project site. The traps shall be arranged in a 10 x 10 grid, with 35-meter spacing between traps.
5. Each sampling grid shall be trapped for a minimum five consecutive days, unless a Mohave ground squirrel is captured before the end of the five-day term on the grid or on another grid on the project site. If no Mohave ground squirrel is captured on a sampling grid on the project site in the first five-consecutive-day term, each sampling grid shall be sampled for a SECOND five-consecutive-day term. Trapping may be stopped before the end of the second term if a Mohave ground squirrel is captured on any sampling grid on the project site. If no Mohave ground squirrel is captured during the second five-consecutive-day term, each sampling grid shall be sampled for a THIRD five-consecutive -day term. The FIRST trapping term shall begin and be completed in the period of 15 March through 30 April. If a SECOND term is required, it shall begin at least two weeks after the end of the first term, but shall begin no earlier than 01 May, and shall be completed by 31 May. If a THIRD term is required, it shall begin at least two weeks after the end of the second term, but shall begin no earlier than 15 June, and shall be completed by 15 July. All trapping shall be conducted during appropriate weather conditions, avoiding periods of high wind, precipitation, and low temperatures (<50°F or 10°C).
6. For projects requiring two or more sampling grids, capture of a Mohave ground squirrel on any grid will establish presence of the species on the project site. Trapping may be stopped on all grids on the

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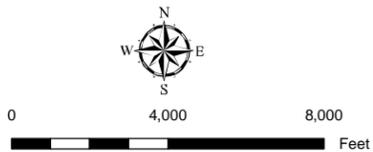
- project site at that time. For linear projects, very large project sites, project sites characterized by fragmented or highly-heterogeneous habitats, or in other special circumstances, continued trapping may be necessary.
7. A maximum 100 traps shall be operated by each qualified biologist. Each trap shall be covered with a cardboard A-frame or equivalent non-metal shelter to provide shade. Trap and shelter orientation shall be on a north-south axis. All traps shall be opened within one hour of sunrise and may be closed beginning one hour before sunset. Traps shall be checked at least once every four hours to minimize heat stress to captured animals. When traps are open, temperature shall be measured at a location within the sampling grid, in the shade, and on foot (approx. 0.3 meters) above the ground at least once every hour. Traps shall be closed when the ambient air temperature at one foot above the ground in the shade exceeds 90°F (32°C). Trapping shall resume on the same day after the ambient temperature at one foot (approx. 0.3 meters) above the ground in the shade falls to 90°F (32°C) and shall continue until one hour before sunset. Suggested baits are mixed grains, rolled oats, or bird seed, with a small amount of peanut butter.
  8. A qualified biologist shall complete the Survey and Trapping Form, which is found on page 5 of these guidelines. This biologist, or the lead agency for the project, shall submit the completed form to the appropriate Department office (see page 4) with the biological report on the project site.
  9. The Department may allow variation on these guidelines, with the advance written approval of the appropriate regional habitat conservation planning office (see page 4). Such variations could include biologically-appropriate modification of the trapping dates or changes in grid configuration that would enhance the probability of detecting Mohave ground squirrels. Any variation which concerns trapping or marking methods must be incorporated into the MOU or permit that authorizes the work.
  10. If a survey conducted according to these guidelines results in no capture or observation of the Mohave ground squirrel on a project site, this is not necessarily evidence that the Mohave ground squirrel does not exist on the site or that the site is not actual or potential habitat of the species. However, in the circumstance of such a negative result, the Department will stipulate that the project site harbors no Mohave ground squirrels. This stipulation will expire one year from the ending date of the last trapping on the project site conducted according to these guidelines.



Note: Coordinates shown are UTM Zone 11, NAD 83, meters

**LEGEND**

- MGS Transect
- - - - - Base Boundary



**Figure 2**  
**Mohave Ground Squirrel**  
**Transect Locations**

## 5.0 RESULTS

No Mohave ground squirrels were captured on these grids, the following tables contain the number of antelope squirrels captured and weather conditions during our trapping sessions.

Appendix A contains photographs of each area trapped and Appendix B contains data summaries for each grid trapped. The following GPS (NAD 83 datum) locations are the start of the of the second or third trap line of each grid:

Grid 1	417366 / 3872923
Grid 7	401945 / 3869011
Grid 8	404003 / 3869288
Grid 12	397459 / 3867569
Grid 13	403215 / 3867907
Grid 16	407235 / 3865997
Grid 19	397161 / 3864735
Grid 20	399072 / 3864353
Grid 21	402180 / 3863818
Grid 27	397417 / 3862721

## 6.0 DISCUSSION

No MGS were trapped during the 2008 surveys at Edwards AFB. This is likely because the transects where trapping occurred were in the northwest part of the base on the extreme edge of the species' range, and because 2008 followed two years of extreme drought in the western Mojave Desert, resulting in reduced populations of MGS and possibly a further retracted range.

## 7.0 LITERATURE CITED

Burt, W. B. and R. P. Grossenheimer.

1976 *A Field Guide to the Mammals*. Houghton Mifflin Co. Boston, MA 289 pp.

California Department of Fish and Game.

2003 *Mohave Ground Squirrel Survey Guidelines*. Unpublished.

Ingles, Lloyd G.

1979 *Mammals of the Pacific States*. Stanford University Press, Stanford, CA. 506pp.

## **Appendix A**

### **Photographs of 2008 Mohave Ground Squirrel Trapping Locations**

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Appendix A Photographs of 2008 Mohave Ground Squirrel Trapping Locations



Transect 1



Transect 12

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**Transect 19**



**Transect 20**

**Appendix B**

**Data Summaries for 2008  
Mohave Ground Squirrel Grids**

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**Appendix B Data Summaries for 2008 Mohave Ground Squirrel Grids**

Temperatures measured 12-inches above substrate in the shade.

**Grid 1**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
4/14/08	0700	7	3	0	10%	0%	10	40
	1500	31						
4/15/08	0700	4	2	0	50%	30%	30	50
	1500	18						
4/16/08	0700	2	0	0	10%	10%	5	20
	1600	22						
4/17/08	0700	3	1	0	10%	10%	0	10
	1700	24						
4/18/08	0700	7	1	0	20%	60%	0	40
	1400	28						

**Grid 7**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
4/26/08	0700	8	0	0	10%	25%	0	10
	1500	29						
4/27/08	0700	14	0	0	30%	80%	15	10
	1700	30						
4/28/08	0700	9	2	0	30%	40%	0	20
	1500	32						
4/29/08	0700	16	0	0	10%	20%	10	15
	1500	28						
4/30/08	0700	14	1	0	20%	20%	10	20
	1500	27						

**Grid 8**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
5/1/08	0700	14	0	0	60%	40%	5	5
	1500	26						
5/2/08	0700	6	1	0	0%	0%	5	15
	1500	26						
5/3/08	0700	12	0	0	0%	0%	10	30
	1600	27						
5/4/08	0700	11	0	0	0%	20%	10	30
	1300	26						
5/5/08	0700	9	1	0	30%	20%	5	10
	1600	25						

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**Grid 12**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
3/30/08	0700	-1	1	0	10%	0%	25	40
	1600	23						
3/31/08	0700	4	1	0	15%	40%	0	40
	1700	26						
4/1/08	0700	6	2	0	10%	25%	10	35
	1500	22						
4/2/08	0700	6	1	0	10%	20%	25	15
	1600	24						
4/3/08	0700	4	0	0	0%	20%	0	30
	1700	27						

**Grid 13**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
4/9/08	0700	5	0	0	10%	0%	30	20
	1600	25						
4/10/08	0700	8	0	0	0%	0%	0	0
	1700	25						
4/11/08	0700	5	0	0	0%	0%	0	50s
	1500	26						
4/12/08	0700	8	0	0	20%	0%	15	10
	1500	27						
4/13/08	0700	4	0	0	0%	0%	8	10
	1700	30						

**Grid 16**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
4/4/08	0700	14	0	0	40%	0%	0	15
	1400	32						
4/5/08	0700	19	0	0	0%	0%	8	20
	1500	32						
4/6/08	0700	16	0	0	20%	0%	10	25
	1400	32						
4/7/08	0700	17	0	0	20%	10%	10	20
	1400	32						
4/8/08	0700	20	0	0	40%	40%	15	20
	1400	32						

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**Grid 19**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
3/15/08	0700	2	0	0	20%	40%	0	30
	1100	15						
3/16/08	0700	4	1	0	30%	50%	30	20
	1400	15						
3/17/08	0700	-2	1	0	0%	0%	0	5
	1500	19						
3/18/08	0700	6	1	0	0%	10%	0	5
	1500	24						
3/19/08	0700	9	0	0	50%	0%	0	20
	1500	26						

**Grid 20**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
3/20/08	0700	10	0	0	40%	10%	5	20
	1400	22						
3/21/08	0700	10	0	0	0%	0%	10	15
	1400	24						
3/22/08	0700	5	1	0	0%	0%	0	10
	1400	23						
3/23/08	0700	10	0	0	0%	0%	0	0
	1300	24						
3/24/08	0700	11	0	0	0%	0%	0	10
	1400	25						

**Grid 21**

DATE	TIME	TEMP °C	CAPTURES		Cloud Cover		Wind speed (Km/hr)/Dir.	
			AGS	MGS	AM	PM	AM	PM
3/25/08	0700	15	0	0	0%	0%	25	25
	1500	25						
3/26/08	0700	12	0	0	0%	0%	30	30
	1400	22						
3/27/08	0700	13	1	0	0%	0%	30	0
	1300	22						
3/28/08	0700	5	1	0	0%	0%	0	10
	1400	21						
3/29/08	0700	7	1	0	0%	0%	25	25
	1500	22						