

**ZEBRA-TAILED LIZARD MONITORING AT  
DIAMOND CREEK ON THE HUALAPAI RESERVATION**

**2017 ANNUAL REPORT**

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**Submitted to:**

Bureau of Reclamation  
Upper Colorado Region  
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## Introduction

The zebra-tailed lizard (ZTL; *Callisaurus draconoides*) is a characteristic, relatively common Mohave and Sonoran Desert species that occurs throughout the lower elevation deserts of the Southwest (Brennon and Holycross 2006). ZTL are a medium-sized, insectivorous iguanid lizard (Figure 1) that prefers sandy desert habitats, which are often dominated by creosote-bush (*Larrea tridentata*; Figure 2). Female ZTL lay 2-8 eggs in summer in sandy, friable soils; however, this species may be multivoltine. Although widespread, isolated populations may occur in sand dune refugia.

Prior to 1983, zebra-tailed lizards were persistent residents of the sand dune area along the Colorado River in Grand Canyon at the Diamond Creek confluence on the Hualapai Indian Reservation (Tomko 1976; Miller et al. 1981; Figure 3). With the flooding that occurred (approximately 100,000 cfs) on the Colorado River in Grand Canyon in 1983-4 due to unexpectedly high runoff from the Rocky Mountains, river access at Diamond Creek for river rafters was restricted to the dune area, and river traffic drove over the dunes. Off-road vehicular impacts are well-known to negatively affect diurnal reptile species, such as desert tortoise and ZTL (Busack and Bury 1974; Webb and Wilshire 1983). Repeated censuses for ZTL at the mouth of Diamond Creek from the late 1980's through 2010 consistently failed to reveal any of these conspicuous, diurnal lizards, and the population was considered extirpated there (Stevens et al. 2011; Stevens 2012). However, ZTL, were still extant in the middle and upper Peach Springs Canyon, several miles south of the Diamond Creek dunes.

Analysis of missing and at-risk species in the Colorado River ecosystem downstream from Glen Canyon Dam identified ZTL as having high potential for restoration (Stevens et al. 2011). In an effort to re-establish ZTL on the dunes at Diamond Creek, the Bureau of Reclamation, Upper Colorado Region, working through the Glen Canyon Dam Adaptive Management Program, funded a translocation effort working with the Hualapai Tribe and Stevens Ecological Consulting, LLC in 2012.

Following the translocation effort in 2012, monthly surveys (April-October) have been performed annually from 2012 to 2017. This report provides survey results from the 2017 surveys and reviews prior years' survey results and discusses trends in the population status of zebra-tailed lizards at Diamond Creek on the Hualapai Reservation.

On August 9 and 10, 2016, there was a large monsoon flood in Peach Springs Canyon that flowed across the Diamond Creek campground and down the wash east of the dune area. This flood deposited fine grain sediments and silt in the campground area and caused a large erosion event in the wash. Surveys following the flood in 2016 found less than one-half the number of zebra-tails compared to prior to the flood (Hualapai Tribe 2016). There was concern that the flood had a significant impact to the zebra-tail population at Diamond Creek and that further translocations may be necessary in 2017.



Figure 1. A male Zebra-tailed lizard at the Diamond Creek dunes in 2015 (Photo by D. Dupree). Males are identified by the blue/black markings on the sides/underbellies behind the front limbs and a distinctly banded tail.



Fig. 2: A photograph of the top of the Diamond Creek dunes in 2015 (Photo by D. DuPree). Vegetation on the dunes is dominated by creosote bush. The Diamond Creek campground can be seen in the background.



Figure 3. Aerial photograph of the Diamond Creek area of the Hualapai Reservation where the zebra-tailed lizards were released in 2012 and surveyed for subsequently. The dune habitats are in the upper center of the photograph. Lizards have also been found throughout much of the terrestrial areas including the wash habitat to the east of the dunes and in the campground/ramada areas during all of the surveys. As mentioned above, the 2016 flood caused significant erosion in the eastern wash at Diamond Creek. Zebra-tailed lizards have not been found in the wash area after the 2016 flood (Hualapai Tribe 2016, this report).

## **Methods**

Details of the capture and translocation activities performed in 2012 can be found in the 2013 Annual Report, Bureau of Reclamation, Salt Lake City, Utah. This report will provide information on the 2017 survey activities and results and compare these data with previous years' data.

In 2017, from April through September, surveys for zebra-tailed lizards were performed at monthly intervals. Dr. Kerry Christensen and Ms. Sharon Wilder of the Hualapai Department of Cultural Resources performed the zebra-tail surveys at the Diamond Creek area by walking around and through the dune area and adjacent dirt habitats on foot (Figure 3). Ms. Wilder only participated in the April and May surveys. The surveys lasted approximately 60 minutes each. We recorded information on behavior, distance to vegetation and vegetation type as well as location when a zebra-tailed lizard was encountered. Determinations of adult versus juvenile versus baby lizards is based on size; babies are less than 3.5 inches, juveniles 3.5 to 5.0 inches and adults are longer than 5.0 inches. Photographs of adult male, adult female, juvenile and baby zebra-tailed lizards are provided in Figures 4-7.

Locations of all lizards encountered during the survey, including zebra-tailed lizards were plotted on an aerial photograph of the dune area (Figure 8). The Project Manager transposed the field aerial photographs to a computer generated version of the aerial photograph with the lizard locations (Figure 8).



Figure 4. A photograph of a male zebra-tailed lizard with the blue/black patch on the sides and the distinctly banded tail.



Figure 5. A photograph of an adult female zebra-tail lizard (Photo by D. Dupree). Note the lack of a blue/black patch on the side and less defined banding of the tail compared to males.





Figure 6. A photograph of a juvenile zebra-tailed lizard (center of photograph). This juvenile is about  $\frac{2}{3}$  the size of an adult. It is hard to visualize the relative size difference without an object for scale.



Figure 7. A photograph of a baby zebra-tailed lizard (center of photo) born in the summer of 2015. Total length of this individual is less than 3.0 inches.

## Results

A good number of zebra-tailed lizards were observed in all of the monthly surveys (Table 1) suggesting that the 2016 flood did not have a significant effect on the zebra-tailed lizard population at Diamond Creek. In fact, during the September survey, a near-record number of zebra-tails were observed (14; record is 15). In addition, five babies were also observed during the September survey indicating that the zebra-tail population was stable and reproducing.

Table 1 shows that a good number of zebra-tailed lizards were observed on all of the 2017 surveys. These data also show that there was one baby observed in April which is very unusual as previous years' surveys did not observe baby lizards until July (Hualapai Tribe 2016). The 14 zebra-tailed lizards observed in September was, in fact, not the record number of observations. Fifteen zebra-tailed lizards were observed during the September, 2015 survey of which four were juveniles and three babies.

Table 1. Summary of 2017 Diamond Creek zebra-tailed lizard monitoring results.

<b>Date</b>	<b># of ztl located/ survey</b>	<b># juveniles</b>	<b># Babies</b>	<b>Mean dist. To veg. (m)</b>	<b>Vegetation type(s)</b>
April 27, 2017	9	1	1	0.61	Creosote, seep willow, mesquite, brittle bush
May 24, 2017	9	1	0	2.45	Creosote, mesquite, brittle bush
June 23, 2017	8	2	0	1.34	Creosote, brittle bush
July 26, 2017	11	0	0	1.95	Creosote, mesquite
August 18, 2017*	7*	1	1	1.57	Creosote, brittle bush
September 15, 2017	14**	0	5	1.61	Creosote, brittle bush, mesquite
<b>Average</b>	<b>8.7</b>	<b>0.83</b>	<b>1.2</b>	<b>1.59</b>	

\*Unusual amount of foot and truck traffic in the campground and on the dune area during this survey.

\*\*Second most zebra-tailed lizards observed on surveys from 2012-2017.

The average numbers of zebra-tailed lizard observations in the surveys from 2012 to 2017 (Table 2) show that 2017 had the second-highest average number of zebra-tailed lizards observed; second only to 2015. The average number of babies in 2017 were also the second-most observed in any year; again second only to the 2015 surveys. The average number of juveniles observed in 2017, however, was the second-lowest number since 2012 (Table 2).

Table 2. A summary of the results of zebra-tailed lizard surveys from 2012 to 2015.

Year	Mean # of ZTL located	Mean # Juveniles	Mean # Babies	Mean distance to vegetation
2012	4.0	0.6	0.0	1.2
2013	3.5	1.0	0.0	1.3
2014	5.6	2.4	0.13 (3 total)	2.0
2015	11.3	2.7	1.70 (10 total)	0.9
2016	7.8	1.33	1.0 (6 total)	0.87
2017	<b>8.7</b>	<b>0.83</b>	<b>1.2 (7 total)</b>	<b>1.59</b>

Figure 8. The locations of lizards (zebra-tail, whiptails and tree lizards) observed on the September, 2017 survey. Zebra-tail lizards are denoted by ZTL, whiptails by W and tree lizards by T. B is for baby zebra-tails.

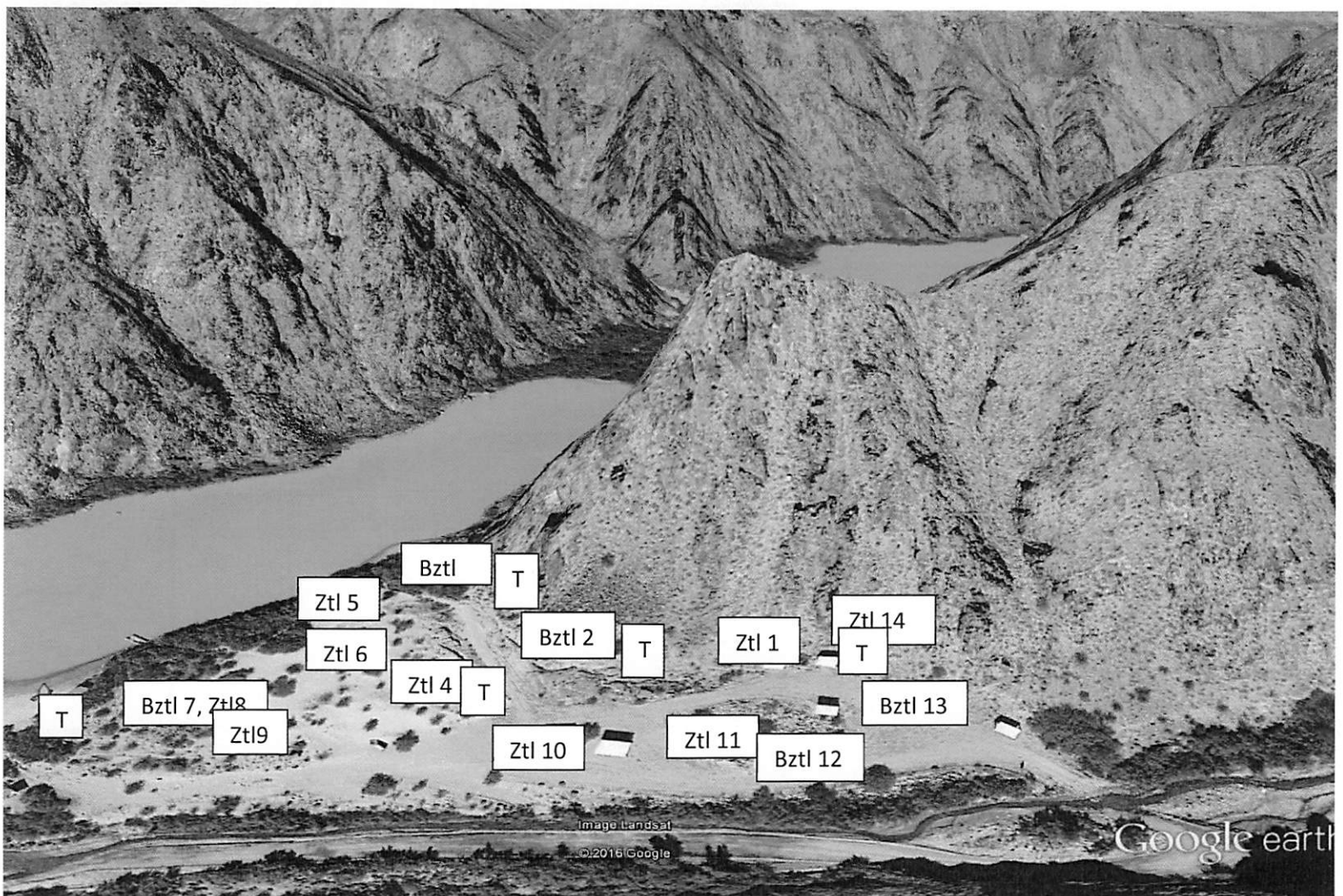




Figure 9. A photograph of the Diamond Creek Wash on the east side of the dune area at Diamond Creek where many zebra-tailed lizards had been found in the past. The August, 2016 monsoon flood eroded a large channel in the middle of the wash. No zebra-tailed lizards were found here in the post-flood surveys in 2016 or 2017.

## Discussion

The results of the 2017 zebra-tailed lizard surveys show that the zebra-tail lizard population at Diamond Creek on the Hualapai Reservation has survived the 2016 flood, and the lizards are continuing to reproduce. These data show that the zebra-tail population is at least stable if not increasing at Diamond Creek. The data also show that reproduction in the population was delayed in 2017 for unknown reasons, but it appears that zebra-tailed lizard reproduction was delayed in other areas of Arizona as well (Christensen, personal observation).

Continued surveys in 2018 and beyond will provide additional information as to the range of natural variation in the zebra-tailed lizard population at Diamond Creek and allow us to make more-informed management decisions in the future. At this time, it does not seem necessary to translocate additional zebra-tail individuals to Diamond Creek in 2017. We will continue to work with Reclamation, Stevens Ecological Services and other interested entities within and outside of the Glen Canyon Dam Adaptive

Management Program to monitor and manage zebra-tailed lizards at Diamond Creek and evaluate potential translocations in the future.

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## APPENDIX A

### 2017 Zebra-tailed Lizard Completed Survey Forms and Associated Aerial Photographs

## Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Sharon Wilder Date 4/27/2017

Start: 09:10AM Finish 10:10AM

Temperature: 74-80 RH 25-20 Wind: 8.0-10.0 mph

1<sup>st</sup> encounter: Behavior: Baby at east edge of dune

Distance to vegetation: 0.5m Vegetation Type creosote bush

2<sup>nd</sup> encounter: Behavior: Adult female at east edge of dune

Distance to vegetation: 0.1 m Vegetation Type Baccharis

3<sup>rd</sup> encounter: Behavior: Adult male at east edge of dune

Distance to vegetation: 0.5 m Vegetation Type creosote bush

4<sup>th</sup> encounter: Behavior: Adult female at top of dune

Distance to vegetation: 0.3 m Vegetation Type creosote bush

5<sup>th</sup> encounter: Behavior: Adult female near the porta-potties

Distance to vegetation: 0.4 m Vegetation Type creosote bush

6<sup>th</sup> encounter: Behavior: Adult male near the porta-potties

Distance to vegetation: 2.0 m Vegetation Type Baccharis

7<sup>th</sup> encounter: Behavior: Juvenile in the sandy area by the old restroom

Distance to vegetation: 0.2 m Vegetation Type mesquite

8<sup>th</sup> encounter: Behavior: Adult female in the rocky area by the path to the beach

Distance to vegetation: 0.5 m Vegetation Type creosote

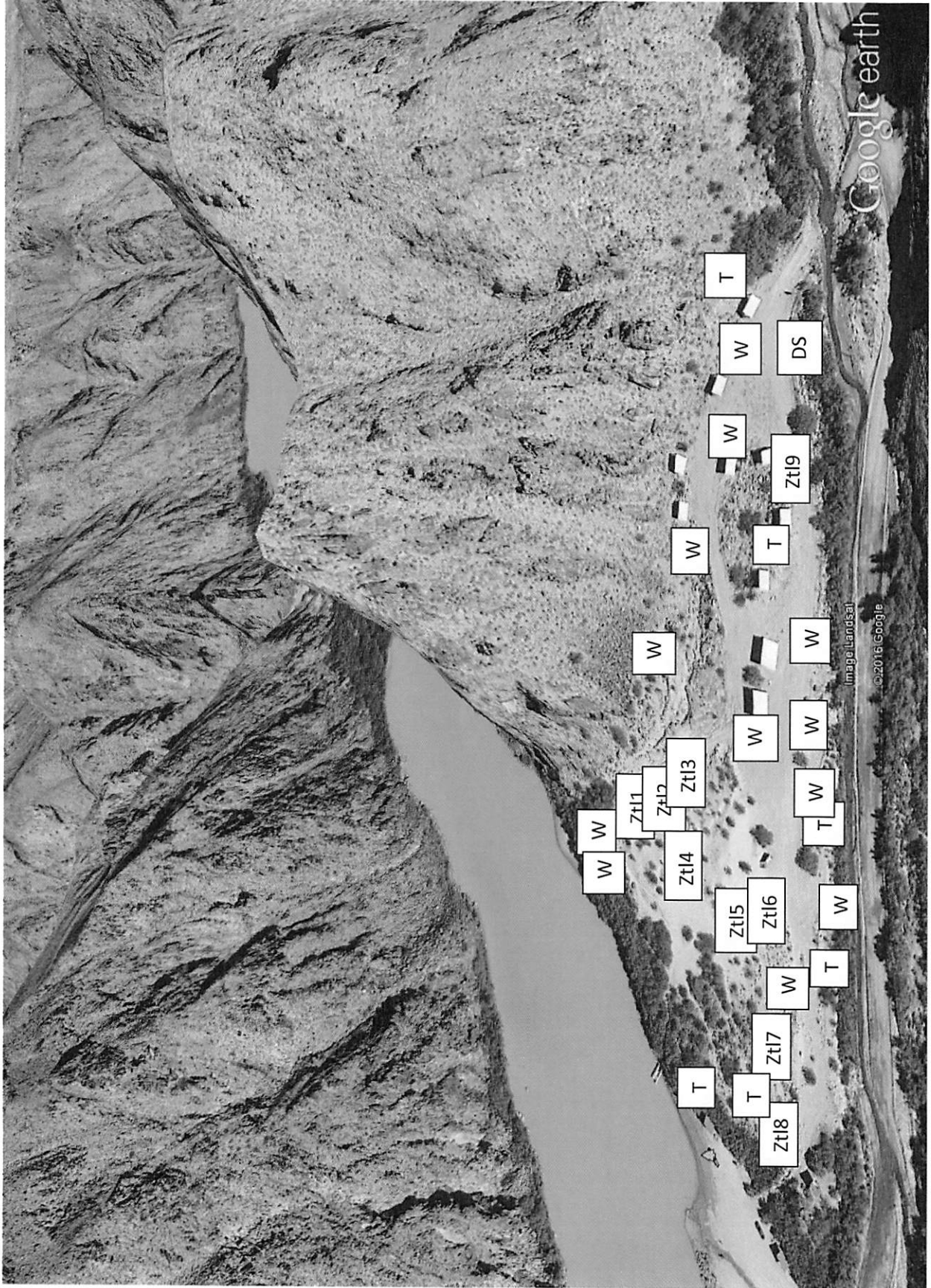
9<sup>th</sup> encounter: Behavior: Adult female in the road by a cabana

Distance to vegetation: 0.1 m Vegetation Type brittle bush

Comments: ants are active



4/27/17



### Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Sharon Wilder Date 05/24/17

Start: 9:30 AM Finish 10:25 AM

Temperature: 82°F-91°F RH 35-26% Wind: 2-3 mph

1<sup>st</sup> encounter: Behavior: Adult female in middle of road in camp ground

Distance to vegetation: 4.0 m Vegetation Type creosote bush

2<sup>nd</sup> encounter: Behavior: Adult female at top of wash

Distance to vegetation: 2.0 m Vegetation Type creosote bush

3<sup>rd</sup> encounter: Behavior: Juvenile at eastern edge of dune

Distance to vegetation: 1.0 m Vegetation Type creosote bush

4<sup>th</sup> encounter: Behavior: Adult in open, ran to cover

Distance to vegetation: 0.1m Vegetation Type brittle bush

5<sup>th</sup> encounter: Behavior: Adult female in open

Distance to vegetation: 2.0 m Vegetation Type mesquite

6<sup>th</sup> encounter: Behavior: Adult female in road

Distance to vegetation: 2.0 m Vegetation Type brittle bush

7<sup>th</sup> encounter: Behavior: Adult female in road

Distance to vegetation: 3.0 m Vegetation Type mesquite

8<sup>th</sup> encounter: Behavior: Adult female with #7 in road

Distance to vegetation: 3.0 m Vegetation Type mesquite

9<sup>th</sup> encounter: Behavior: Adult female next to ramada

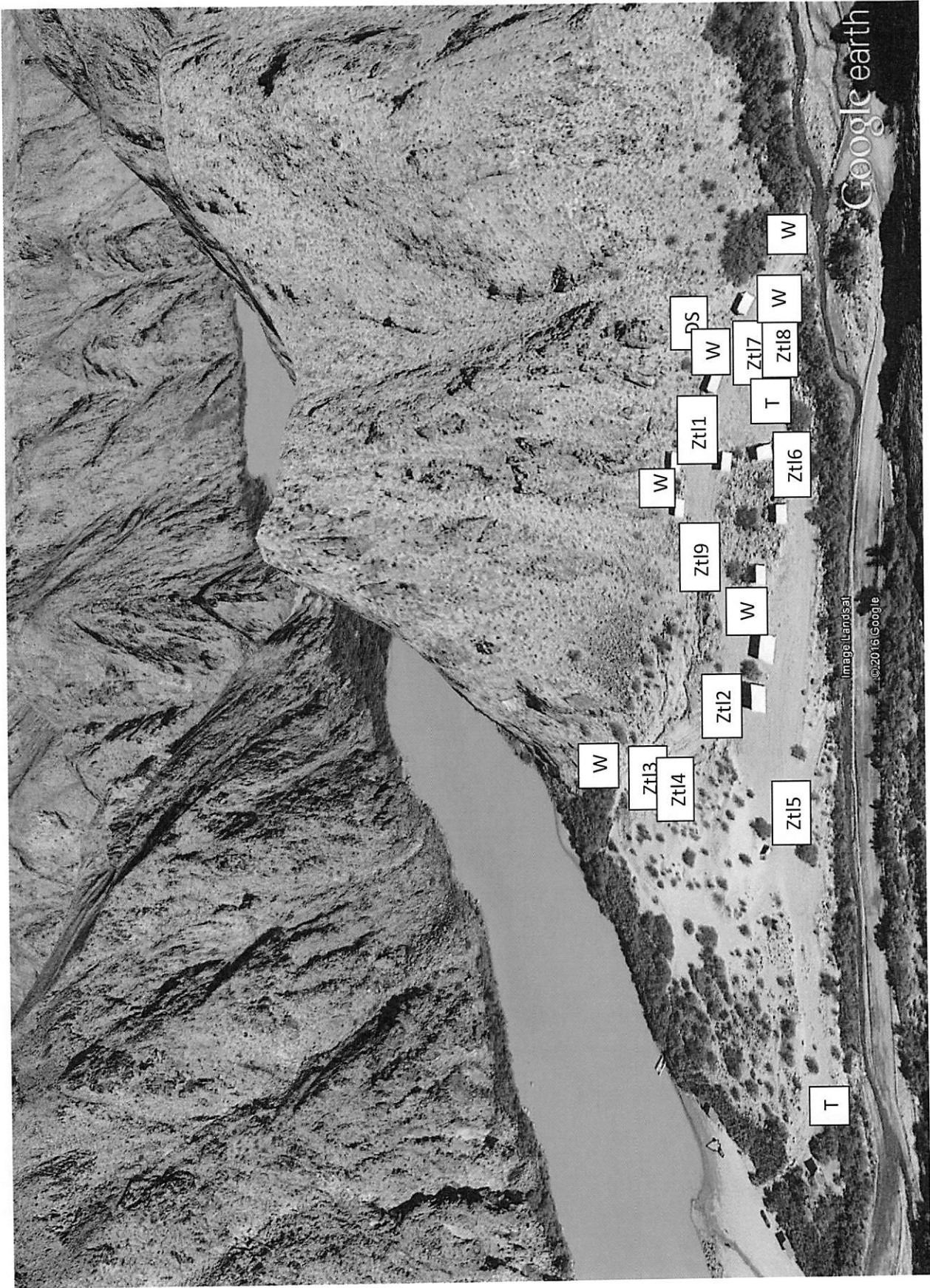
Distance to vegetation: 4.0 m Vegetation Type creosote bush

Comments: lots of ants

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Google earth

Image Landsat  
© 2016 Google

W

Zt13

Zt14

Zt12

W

Zt19

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Zt11

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PS

Zt17

Zt18

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Zt16

**Zebra-tailed Lizard Monitoring Form**

Monitor(s): Kerry Christensen Date 6/23/17

Start: 8:55AM Finish 9:50AM

Temperature: 92-105°F RH 32-22% Wind: 1-2mph

1<sup>st</sup> encounter: Behavior: Adult between ramadas 1 and 2 ran into brittle bush

Distance to vegetation: 2.0 m Vegetation Type brittle bush

2<sup>nd</sup> encounter: Behavior: Juvenile at east side of dune

Distance to vegetation: 1.0m Vegetation Type creosote bush

3<sup>rd</sup> encounter: Behavior: Adult female at east side of dune

Distance to vegetation: 0.5 m Vegetation Type creosote bush

4<sup>th</sup> encounter: Behavior: Adult female west side of dune

Distance to vegetation: 3.0 m Vegetation Type creosote bush

5<sup>th</sup> encounter: Behavior: Adult pregnant female under old ramada

Distance to vegetation: 2.0 m Vegetation Type creosote bush

6<sup>th</sup> encounter: Behavior: Juvenile on the side of the restroom trail in rocks

Distance to vegetation: 0.2 m Vegetation Type brittle bush

7<sup>th</sup> encounter: Behavior: Adult male under ramada

Distance to vegetation: 1.0 m Vegetation Type creosote bush

8<sup>th</sup> encounter: Behavior: Adult female next to truck and ramada #1

Distance to vegetation: 1.0 m Vegetation Type brittle bush

Comments: truck and campers at last ramada. Lots of foot traffic from beach to porta-potties. Very hot; even zebra-tails seeking shade.

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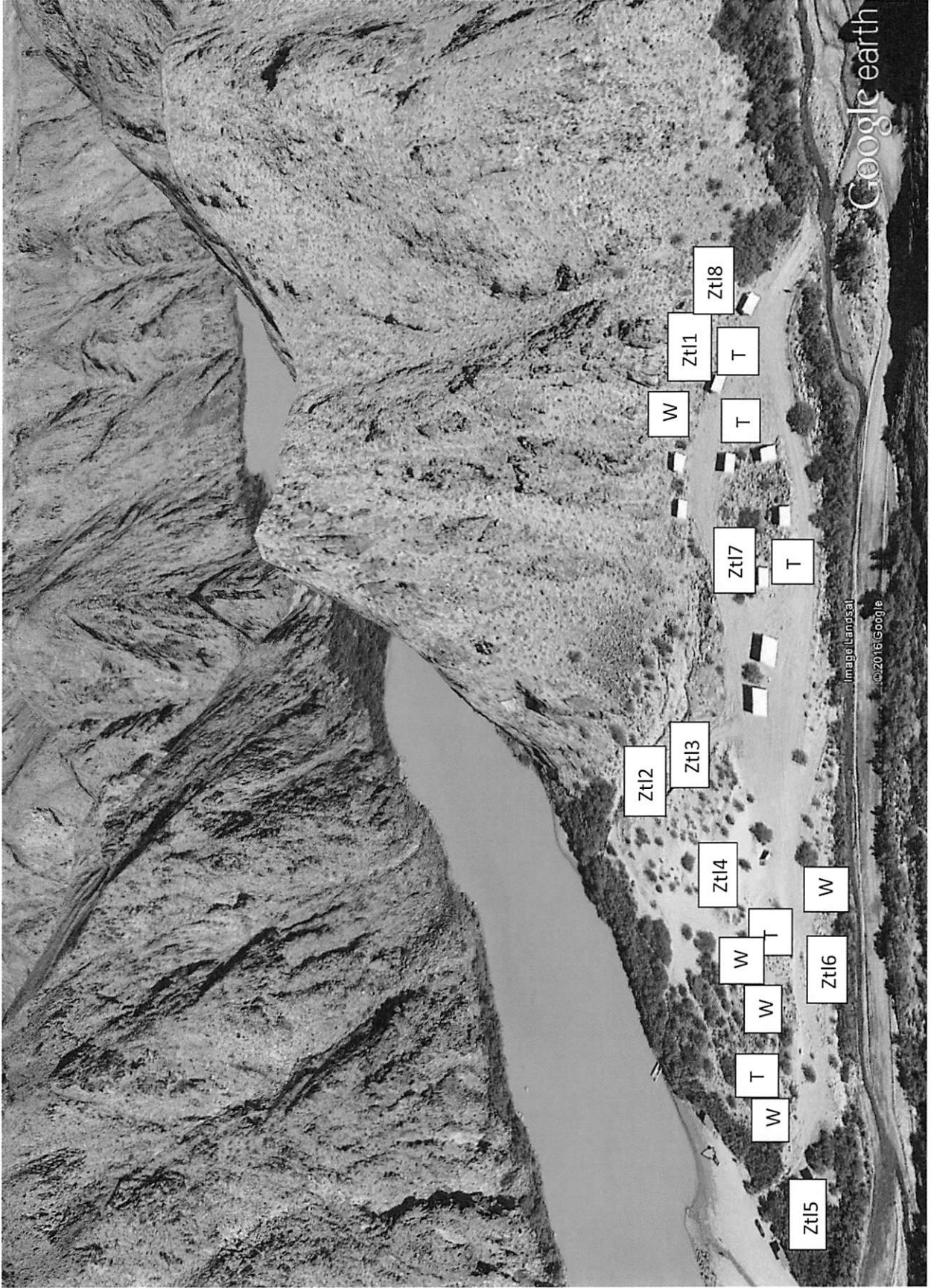
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6/23/17



### Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 7/26/17

Start: 9:00AM Finish 9:57AM

Temperature: 80-87°F RH 65-67% Wind: 0-3 mph

1<sup>st</sup> encounter: Behavior: Adult female in road between ramadas 2 & 3

Distance to vegetation: 5.0 m Vegetation Type creosote bush

2<sup>nd</sup> encounter: Behavior: Adult female at top of wash

Distance to vegetation: 2.0 m Vegetation Type creosote bush

3<sup>rd</sup> encounter: Behavior: Adult female at top of dune

Distance to vegetation: 1.5 m Vegetation Type mesquite

4<sup>th</sup> encounter: Behavior: Adult male in front of porta potties

Distance to vegetation: 2.0 m Vegetation Type creosote bush

5<sup>th</sup> encounter: Behavior: Adult female near number four adult male near PP

Distance to vegetation: 3.0 m Vegetation Type creosote bush

6<sup>th</sup> encounter: Behavior: Adult female at north edge of dune

Distance to vegetation: 1.0 m Vegetation Type creosote bush

7<sup>th</sup> encounter: Behavior: Pregnant female behind porta potties

Distance to vegetation: 2.0 m Vegetation Type creosote bush

8<sup>th</sup> and 9<sup>th</sup> encounter: Behavior: Male and female w/in 1 meter of each other between ramada #1 and #2

Distance to vegetation: 4.0 m Vegetation Type mesquite

10<sup>th</sup> and 11<sup>th</sup> encounter: Behavior: Male and female together (w/in 1 m) on east edge of dune

Distance to vegetation: 1.0 m Vegetation Type creosote bush

Comments:: Some flooding has occurred in campground and some grading has taken place. Probably from 7/25/17 storm. Additional erosion has occurred in the wash from last storm. Toads calling and baby toads jumping all around. Bus loads of people arrived around 9:20 and were walking everywhere including all over the dunes. I was able to observe some zebra-tails because they were spooked by the visitors.

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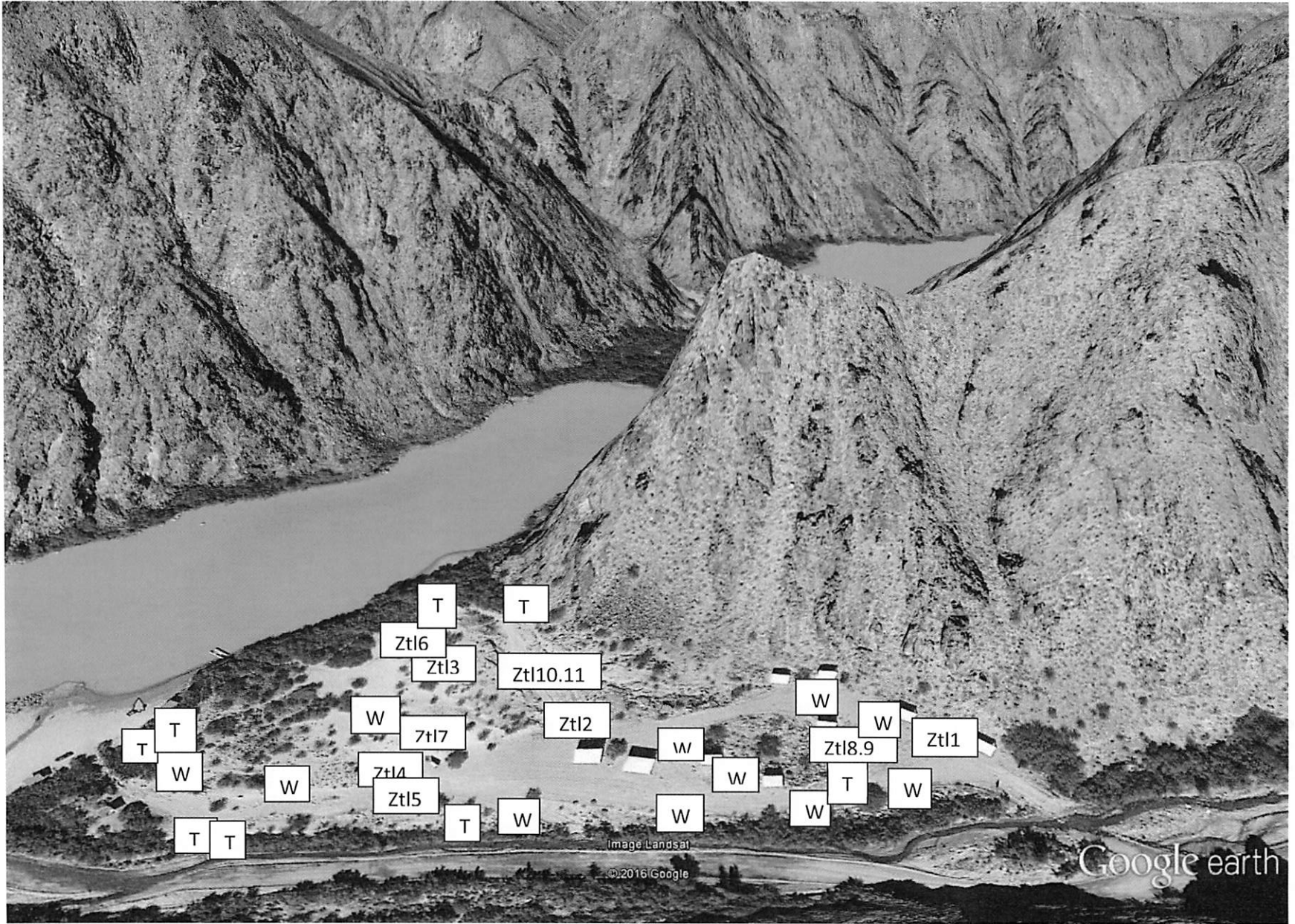
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2/26/17



**Zebra-tailed Lizard Monitoring Form**

Monitor(s): Kerry Christensen Date 8/18/17

Start: 9:40 AM Finish 10:40 AM

Temperature: 90-96°F RH 35-25% Wind: 1-3 mph

1<sup>st</sup> encounter: Behavior: Adult in road near Ramada #2, ran 20 yards

Distance to vegetation: 4.0 m Vegetation Type creosote bush

2<sup>nd</sup> encounter: Behavior: Adult female in rocks near Ramada #4

Distance to vegetation: 0.5 m Vegetation Type brittle bush

3<sup>rd</sup> encounter: Behavior: Juvenile near the top of the wash

Distance to vegetation: 1.0 m Vegetation Type creosote bush

4<sup>th</sup> encounter: Behavior: Adult female on the east side of the dune

Distance to vegetation: 1.5 m Vegetation Type creosote bush

5<sup>th</sup> encounter: Behavior: Adult on northwest side of dune

Distance to vegetation: 2.5 m Vegetation Type creosote bush

6<sup>th</sup> encounter: Behavior: Adult male in rocks near beach path

Distance to vegetation: 0.5 m Vegetation Type creosote bush

7<sup>th</sup> encounter: Behavior: Baby north of the porta potties in open, ran to grass clump

Distance to vegetation: 1.0 m Vegetation Type unknown grass clump

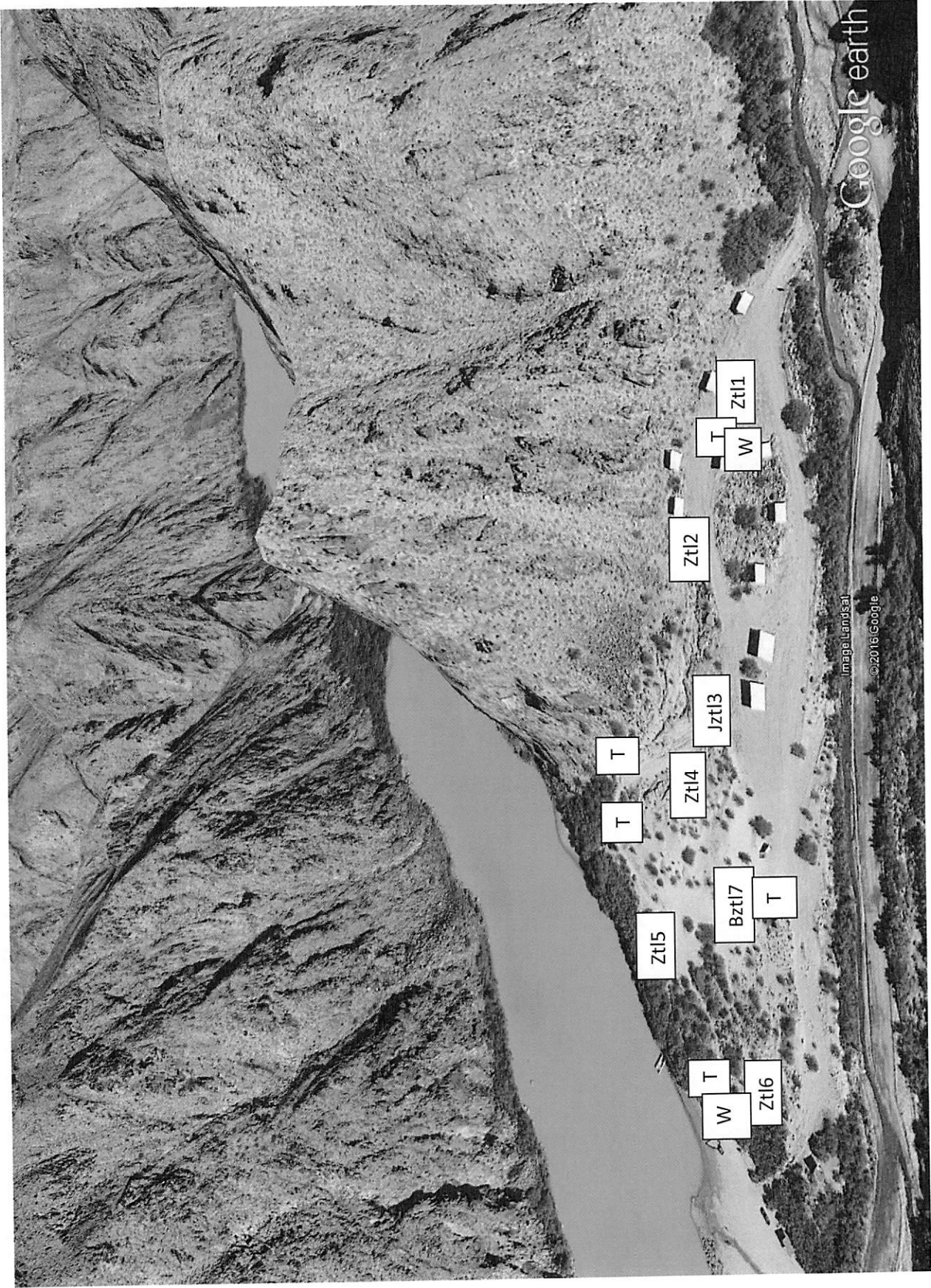
8<sup>th</sup> encounter: Behavior: \_\_\_\_\_

Distance to vegetation: \_\_\_\_\_ Vegetation Type \_\_\_\_\_

Comments: Porta potty service truck just left. River runner truck and van full of people in campground. Lots of traffic from the beach to the porta potties. Zoo in the campground.

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8/18/17



Google earth

Image Landsat © 2016 Google

### Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen Date 9/15/17

Start: 11:10AM Finish 12:00PM

Temperature: 90-92°F RH 26-27% Wind: 2-8 mph

1<sup>st</sup> encounter: Behavior: Adult in road beside Ramada #4

Distance to vegetation: 4.0 m Vegetation Type creosote bush

2<sup>nd</sup> encounter: Behavior: Baby adjacent to wash and near top of wash

Distance to vegetation: 1.0 m Vegetation Type creosote bush

3<sup>rd</sup> encounter: Behavior: Baby at north-eastern edge of dune

Distance to vegetation: 0.1 Vegetation Type bunch grass

4<sup>th</sup> encounter: Behavior: Adult female at west side of dune; ran 4 m to mesquite

Distance to vegetation: 2.0 m Vegetation Type creosote bush

5<sup>th</sup> encounter: Behavior: Adult at north-east edge of dune

Distance to vegetation: 3.0 m Vegetation Type creosote bush

6<sup>th</sup> encounter: Behavior: Adult male at southwest edge of dune

Distance to vegetation: 1.0 m Vegetation Type creosote bush

7<sup>th</sup> encounter: Behavior: Baby in rocks with #8 adult below. Approx 1ft.apart

Distance to vegetation: 0.1 m Vegetation Type brittle bush

8<sup>th</sup> encounter: Behavior: Adult female in rocks with #7 above. Approx 1 ft. apart

Distance to vegetation: 0.2m Vegetation Type brittle bush

9<sup>th</sup> encounter: Behavior: Adult by old porta-potty

Distance to vegetation: 0.5 m Vegetation Type bunch grass

10<sup>th</sup> encounter: Behavior: Adult female at edge of road

Distance to vegetation: 0.5 m Vegetation Type brittle bush

11<sup>th</sup> encounter: Behavior: Adult male at eastern edge of road

Distance to vegetation: 7.0 m Vegetation Type cat claw (*Acacia greggii*)

12<sup>th</sup> encounter: Behavior: Baby in road

Distance to vegetation: 2.0 m Vegetation Type mesquite

13<sup>th</sup> encounter: Behavior: Baby by ramada #10

Distance to vegetation: 1.0 m Vegetation Type brittle bush

14<sup>th</sup> encounter: Behavior: Adult near Ramada #2

Distance to vegetation: 0.2 Vegetation Type sand verbena

Comments:: Minimal foot traffic. Beautiful day!

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