

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

2015 FINAL REPORT

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Submitted to:

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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 extirpated there (Stevens et al. 2011; Stevens 2012). However, ZTL, are 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 have been performed annually from 2012 to 2015. This report provides survey results from the 2015 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.



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. The dune habitats are in the upper center of the photograph. Lizards were also often found in the wash habitat to the right of the dunes in this photograph and in the campground/ramada areas of the Diamond Creek confluence area.

METHODS

Details of the capture and translocation activities performed in 2012 can be found in the 2013 Final Report, Bureau of Reclamation, Salt Lake City, Utah. This report will provide information only on the 2015 survey activities and results.

In 2015, from May to October, surveys for zebra-tailed lizards were performed at monthly intervals. Dr. Kerry Christensen and Ms. Donata Dupree of the Hualapai Department of Natural Resources performed the zebra-tail surveys at the Diamond Creek dunes by walking around and through the dune area and adjacent dirt habitats on foot (Table 1). Ms. Rosa Amador (volunteer) assisted on the July 8, 2015 survey. The surveys lasted approximately 60 minutes each. We recorded information on behavior, distance to vegetation and vegetation type as well as location. Determinations of adult versus juvenile versus baby lizards is based on size. Photographs of adult male, adult female, juvenile and baby zebra-tails are provided in Figures 4-7.

Locations of all lizards encountered during the survey, including zebra-tailed lizards were plotted on a aerial photograph of the dune area (Figure 8). The GIS Technician transposed the field aerial photograph 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 the presence of yellow arm pits.



Figure 6. A photograph of a juvenile zebra-tailed lizard (center of photograph). This juvenile is about $2/3$ 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 2.5 inches.

RESULTS

A good number of zebra-tailed lizards were observed in all of the monthly surveys (Table 1). Juveniles were observed in all the monthly surveys and in very good numbers in September and October (Table 1). Baby zebra-tails were observed in all the surveys except May and June (Table 1).

In 2015, the total number of zebra-tailed lizards observed during the monthly surveys was higher than in previous years (Table 2). More juveniles and babies were also observed in 2015 compared to previous years (Table 2). It is interesting that in 2015, zebra-tailed lizards outnumbered both whiptail lizards and tree lizards in the numbers of

lizards observed during the surveys (Appendix B). This was not as evident as in previous years' surveys (See 2014 and 2013 Final Reports, Upper BOR). The completed survey forms are provided as Appendix A along with the May- October aerial photos (Appendix B).

Zebra-tailed lizards were found in many areas of the project area (Figure 8 and Appendix B). The greatest concentrations seemed to vary during the survey period, but the eastern wash, dune area and road and campground area were occupied consistently during 2015 (Appendix B).

Table 1. Summary of 2015 Diamond Creek zebra-tailed lizard monitoring results.

Date	# of ztl located/ survey	# juveniles	# Babies	Mean dist. To veg. (m)	Vegetation type(s)
May 1, 2015	9	1	0	0.7	Sand verbena, mesquite, creosote, brittle bush
June 4, 2015	8	2	0	1.2	Sand verbena, creosote, brittle bush
July 8, 2015	13	1	5	1.0	Brittle bush, creosote, seep willow, arrowweed
August 13, 2015	9	1	1	0.5	Sand verbena, arrowweed, creosote, catclaw
September 11, 2015	14	7	1	0.8	Creosote, mesquite, sand verbena
October 2, 2015	15	4	3	1.0	Sand verbena, creosote, mesquite
Average	11.3	2.7	1.7	0.9	

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

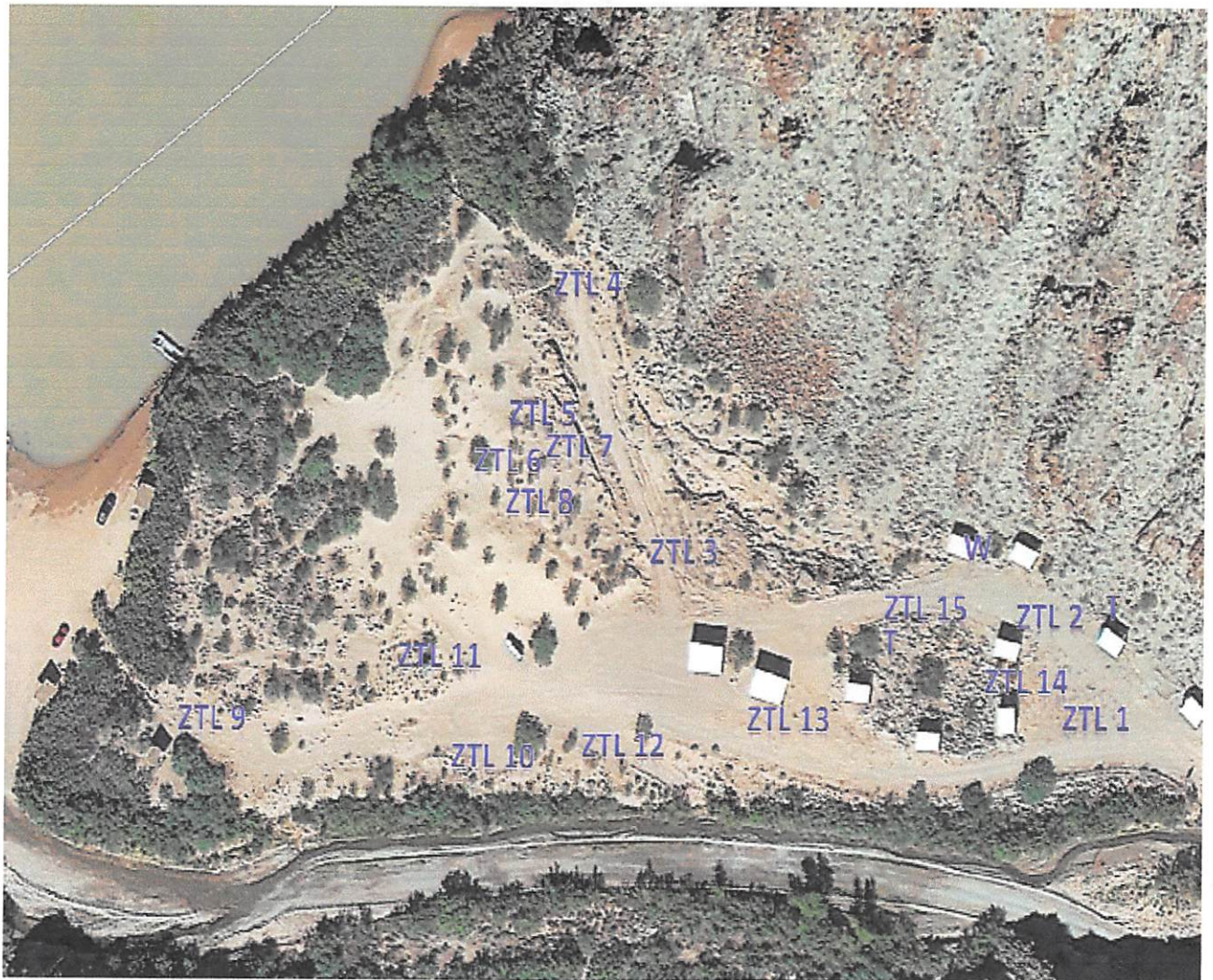


Figure 8. The locations of lizards (zebra-tail, whiptails and tree lizards) observed on the October, 2015 survey. Zebra-tail lizards are denoted by ZTL, whiptails by W and tree lizards by T.

DISCUSSION AND RECOMMENDATIONS

That more zebra-tailed lizards were observed in 2015 compared to 2014 and 2013 suggests that the translocation of zebra-tailed lizards to the Diamond Creek dune are in 2012 has resulted in a stable, reproducing sustainable population. The increased numbers of baby and juvenile lizards observed in 2015 support the idea that this population is stable and sustainable.

That the number of whiptail and tree lizards has declined relatively to the number of zebra-tailed lizards suggests that the presence of zebra-tail lizards may affect the population dynamics of these two other species. This is not instinctively apparent from our experiences in the field where we typically have found the different species in different micro-habitat types. Further investigations could shed light on this observed pattern.

That zebra-tailed lizards were observed a many different areas of the project area, and that their locations varied with time suggests that different microhabitats may be important for food, cover and reproductive purposes during the year. Future investigations could yield information as to the observed patterns of lizard dispersions.

Additional translocations of additional zebra-tails in the as a way to increase the genetic diversity of the Diamond Creek zebra-tailed lizard population should be considered after discussions with the principal investigators, Reclamation, appropriate ecologists other lizard experts. Following the 2015 monitoring season, we advocate a meeting among Reclamation staff, interested Glen Canyon Dam Adaptive Management Program Technical Workgroup members and others to discuss the future direction of the project.

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APPENDIX A

2015 Zebra-tailed Lizard Completed Survey Forms

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata DuPree Date May 1, 2015

Start: 9:45A Finish 10:50Am

Temperature 86-92^{oF} RH 34-29% Wind: 2.0

1st encounter: Behavior adult in open near ramada #1

Distance to vegetation: 3.0m Vegetation Type sand verbena

2nd encounter: Behavior: Juvenile on south edge of dune

Distance to vegetation: 0.5m Vegetation Type brittle bush

3rd encounter: Behavior: Adult in road near central vegetation patch

Distance to vegetation: 0.5m Vegetation Type creosote bush

4th encounter: Behavior: in road, ran to bush

Distance to vegetation: 0.5m Vegetation Type brittle bush

5th encounter: Behavior: male and female in road by ramada, male doing push ups

Distance to vegetation: 0.5m Vegetation Type Brittle bush

6th encounter: Behavior: female from #5 above was much smaller than male

Distance to vegetation: 0.5m Vegetation Type brittle bush

7th encounter: Behavior: edge of mesquite near ramada

Distance to vegetation: 0.2m Vegetation Type mesquite

8th encounter: Behavior: adult in road

Distance to vegetation: 0.5m Vegetation Type brittle bush

9th encounter. Behavior in shade, ran to creosote

Distance to vegetation 0.1m Vegetation Type Seep Willow

Comments: lots of ants and people walking around dunes

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata Dupree Date June 4, 2015

Start: 9:25AM Finish 10:05

Temperature: 82-88°F RH 22-18 Wind: 2.0mph

1st encounter: Behavior: Adult in open road, ran 20m

Distance to vegetation: 4m Vegetation Type sand verbena

2nd encounter: Behavior: Adult on side of dune, south end

Distance to vegetation: 1m Vegetation Type creosote

3rd encounter: Behavior: Adult at north end of dune

Distance to vegetation: 0.0m Vegetation Type creosote

4th encounter: Behavior: Adult northwest edge of dune near rocks

Distance to vegetation: 0.5m Vegetation Type creosote

5th encounter: Behavior: Adult female in rocks northwest of dune

Distance to vegetation: 0.5m Vegetation Type creosote

6th encounter: Behavior: Juvenile in rocks near last adult

Distance to vegetation: 0.5m Vegetation Type creosote

7th encounter: Behavior: Juvenile on trail from beach to toilets

Distance to vegetation: 2.0m Vegetation Type brittle bush

8th encounter: Behavior: Adult in road by armadas, ran south 10 m

Distance to vegetation: 1.0 Vegetation Type brittle bush

Comments: lots of red ants, all lizards looked and acted healthy

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata DuPree, Rosa Amador Date 07/08/2015

Start: 09:00 Finish 09:55

Temperature: 90°F-94°F RH 25-40 Wind: 0.0-2.0

1st encounter: Behavior: Juvenile in rocks at second ramada

Distance to vegetation: 0.5m Vegetation Type brittle bush

2nd encounter: Behavior: Baby under shrub

Distance to vegetation: 0.0m Vegetation Type seep willow

3rd encounter: Behavior: Adult female in wash, middle of trail to river

Distance to vegetation: 1.0m Vegetation Type arroyo weed

4th encounter: Behavior: Adult female in wash, middle of trail

Distance to vegetation: 2.0m Vegetation Type arroyo weed

5th encounter: Behavior: Adult male at top of dune

Distance to vegetation: 1.0m Vegetation Type creosote bush

6th encounter: Behavior: Adult on dune

Distance to vegetation: 1.0m Vegetation Type creosote bush

7th encounter: Behavior: Baby on dune

Distance to vegetation: 1.5m Vegetation Type creosote bush

8th encounter: Behavior: Adult on edge of dune

Distance to vegetation: 0.5m Vegetation Type creosote bush

9th encounter: Behavior: Baby on SW edge of dune

Distance to vegetation: 1.0m Vegetation Type creosote bush

10th encounter: Behavior: Adult in rocks

Distance to vegetation: 1.0m Vegetation Type creosote bush

11th encounter: Behavior: Baby adjacent to path to porta-potties

Distance to vegetation: 0.5m Vegetation Type grass

12th encounter: Behavior: Adult at edge of clearing

Distance to vegetation: 1.0m Vegetation Type brittle bush

13th encounter: Behavior: Baby on ramp down to creek sitting on rock

Distance to vegetation: 1.5m Vegetation Type brittle bush

Comments: lots of ants, lots of foot traffic from upstream beach across dunes, lots of foot traffic to porta-potties.

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata DuPree Date August 13, 2015

Start: 9:20A Finish 10:30A

Temperature: 90-97° F RH 60% Wind: 3-4mph

1st encounter: Behavior: Juvenile near next to last ramada in road

Distance to vegetation: 0.5m Vegetation Type sand verbena

2nd encounter: Behavior: Baby on east edge of dune

Distance to vegetation: 0.1m Vegetation Type creosote

3rd encounter: Behavior: Adult female at west edge of dune

Distance to vegetation: 0.5m Vegetation Type arrowweed

4th encounter: Behavior: Adult female north edge of dune

Distance to vegetation: 0.1m Vegetation Type arrowweed

5th encounter: Behavior: Adult male by outhouses on rock

Distance to vegetation: 2.0m Vegetation Type creosote

6th encounter: Behavior: Adult female under catclaw

Distance to vegetation: 0.0m Vegetation Type catclaw

7th encounter: Behavior: Baby under same catclaw

Distance to vegetation: 0.0m Vegetation Type catclaw

8th encounter: Behavior: Adult female by third from last ramada

Distance to vegetation: 0.2m Vegetation Type sand verbena

9th encounter: Behavior: Adult female north end of dune

Distance to vegetation: 0.0m Vegetation Type creosote

Comments: lots of ants tamarisk beetle defoliation near 100%, lots of beetles on remaining tamarisk vegetation.

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata DuPree Date 09/11/2015

Start: 09:30AM Finish 10:30AM

Temperature: 76-96° F RH 33-20% Wind: 0-3mph

1st encounter: Behavior: Juvenile in road

Distance to vegetation: 0.5m Vegetation Type creosote

2nd encounter: Behavior: Juvenile next to mesquite next to road

Distance to vegetation: 1.0m Vegetation Type mesquite

3rd encounter: Behavior: Juvenile at top of wash

Distance to vegetation: 2.0m Vegetation Type sand verbena

4th encounter: Behavior: Adult end of wash

Distance to vegetation: 0.2m Vegetation Type mesquite

5th encounter: Behavior: Adult female end of wash, 2.0m from #4

Distance to vegetation: 0.2m Vegetation Type mesquite

6th encounter: Behavior: Juvenile at east edge of dune

Distance to vegetation: 0.1m Vegetation Type grass

7th encounter: Behavior: Juvenile at west edge of dune

Distance to vegetation: 0.1m Vegetation Type creosote

8th encounter: Behavior: Adult at top of dune

Distance to vegetation: 0.5m Vegetation Type Mesquite

9th encounter Behavior Juvenile north of dune

Distance to vegetation: 2.0m Vegetation type mesquite

10th encounter Behavior Juvenile across from porta potties

Distance to vegetation: 0.1m Vegetation type mesquite

11th encounter Behavior Adult female down toward diamond creek

Distance to vegetation: 0.1 Vegetation type creosote

12th encounter Behavior Adult female middle of road

Distance to vegetation: 3.0m Vegetation type mesquite

13th encounter Behavior Baby at top of wash

Distance to vegetation: 1.0 Vegetation type sand verbena

14th encounter Behavior Adult female mid wash

Distance to vegetation: 0.2m Vegetation type sand verbena

15th encounter Behavior _____

Distance to vegetation: _____ Vegetation type _____

Comments:: black and red ants

Zebra-tailed Lizard Monitoring Form

Monitor(s): Kerry Christensen, Donata DuPree Date 10/02/2015

Start: 9:45AM Finish 10:40AM

Temperature: 80-90° F RH 24-11% Wind: 3.0mph

1st encounter: Behavior: Adult female in road

Distance to vegetation: 4.0m Vegetation Type sand verbena

2nd encounter: Behavior: Adult between ramada 2 and 3

Distance to vegetation: 2.0m Vegetation Type sand verbena

3rd encounter: Behavior: Juvenile at top of wash

Distance to vegetation: 1.0m Vegetation Type creosote

4th encounter: Behavior: Adult female at bottom of wash between bushes

Distance to vegetation: 0.5 Vegetation Type mesquite

5th encounter: Behavior: Baby on top of dune

Distance to vegetation: 0.2m Vegetation Type creosote

6th encounter: Behavior: Adult male on top of dune

Distance to vegetation: 0.1m Vegetation Type creosote

7th encounter: Behavior: Adult female top of dune

Distance to vegetation: 0.1m Vegetation Type creosote

8th encounter: Behavior: Baby at western edge of dune

Distance to vegetation: 0.1m Vegetation Type sand verbena

9th encounter: Behavior: Adult female by river camp site

Distance to vegetation: 0.2 Vegetation Type grass

10th encounter: Behavior: Juvenile west of porta potties

Distance to vegetation: 1.0m Vegetation Type mesquite

11th encounter: Behavior: Juvenile at western edge of dune

Distance to vegetation: 1.0m Vegetation Type creosote

12th encounter: Behavior: Adult female near ramp to Diamond Creek

Distance to vegetation: 0.5m Vegetation Type creosote

13th encounter: Behavior: Baby next to ramada

Distance to vegetation: 0.1m Vegetation Type sand verbena

14th encounter: Behavior: Juvenile in open

Distance to vegetation: 2.0m Vegetation Type sand verbena

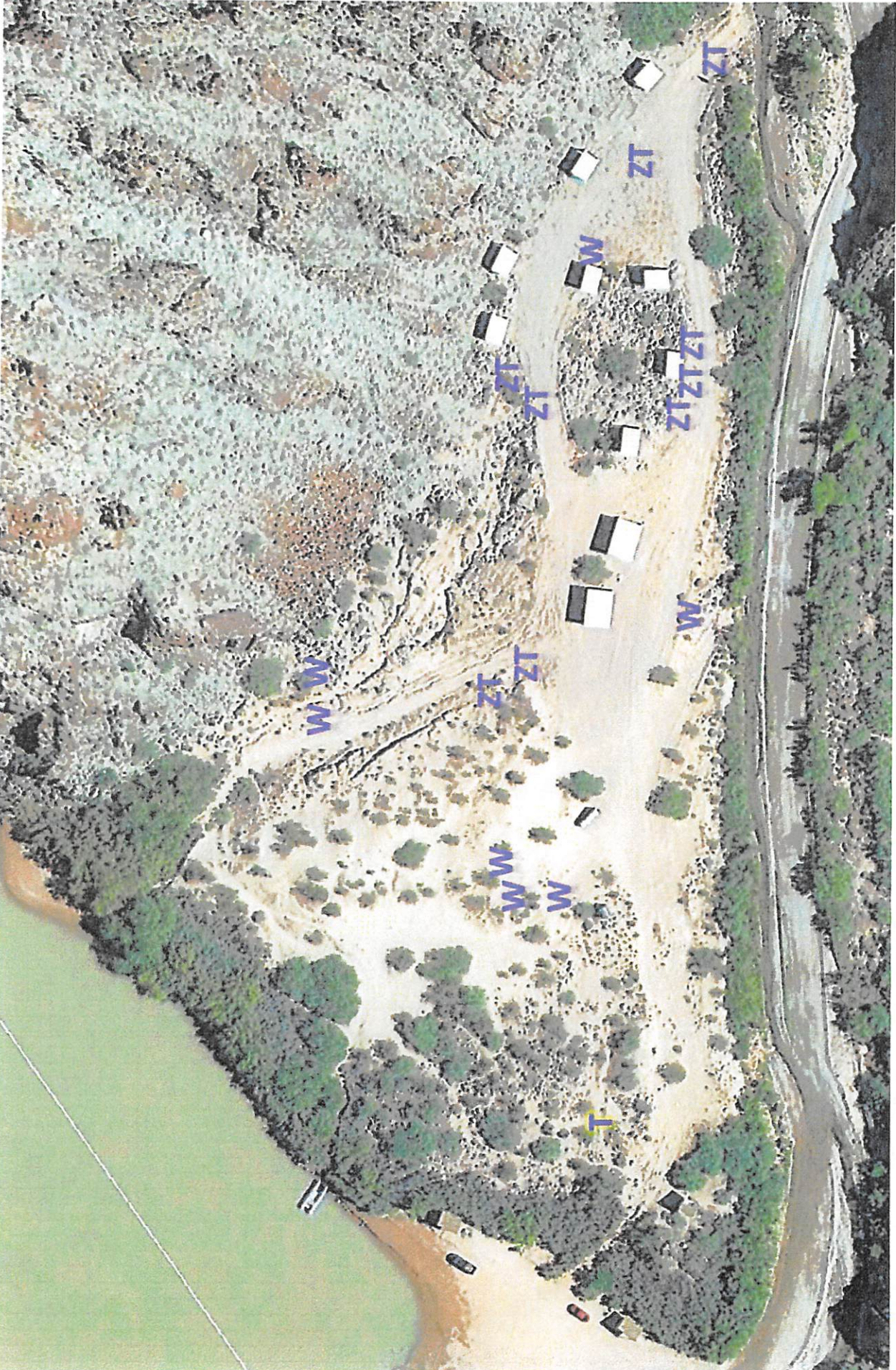
15th encounter: Behavior: Adult male next to last ramada

Distance to vegetation: 2.0m Vegetation Type mesquite

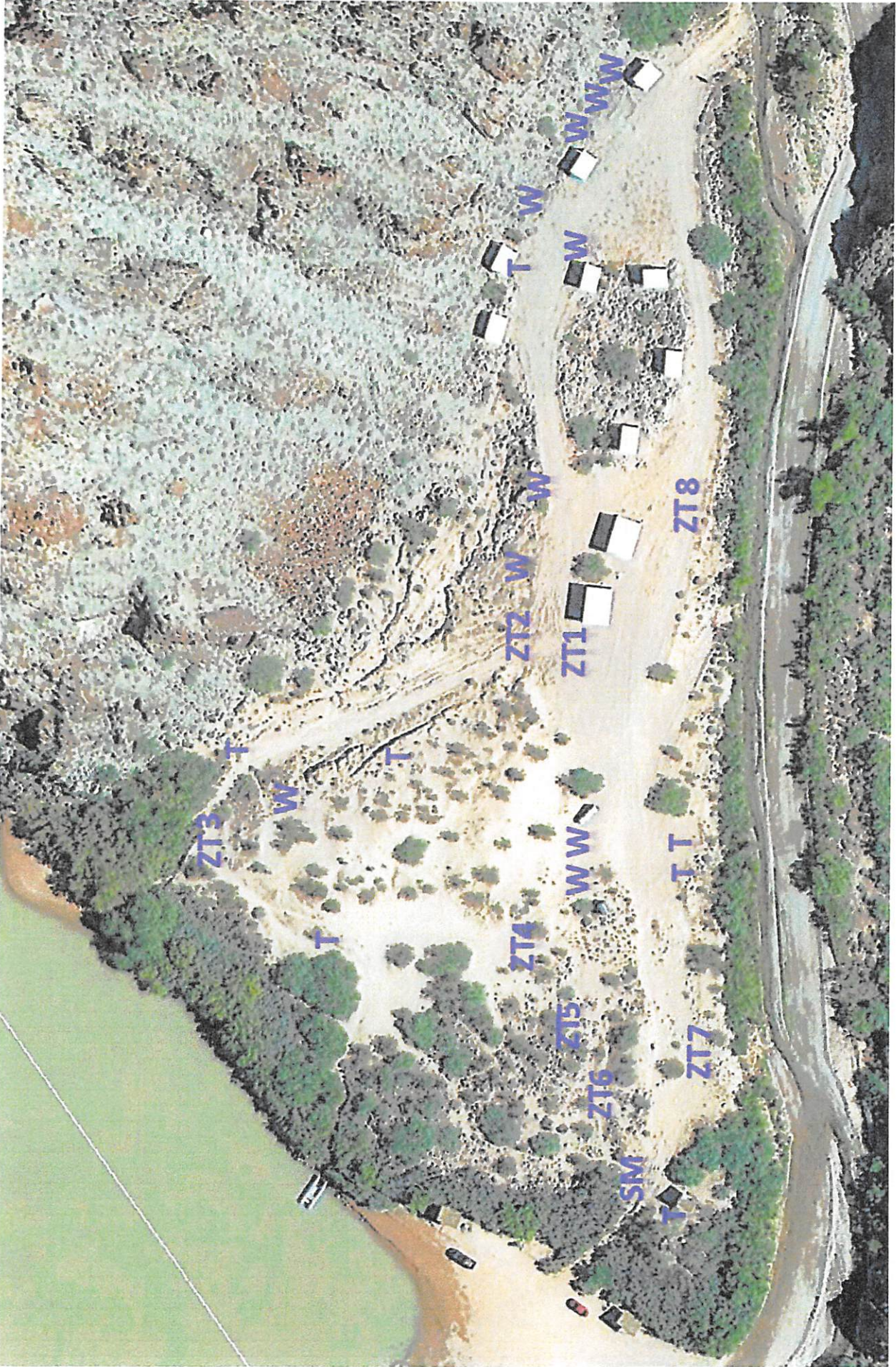
Comments:: ants still very active

APPENDIX B

2015 Zebra-tailed Lizard Survey Completed Aerial Photographs

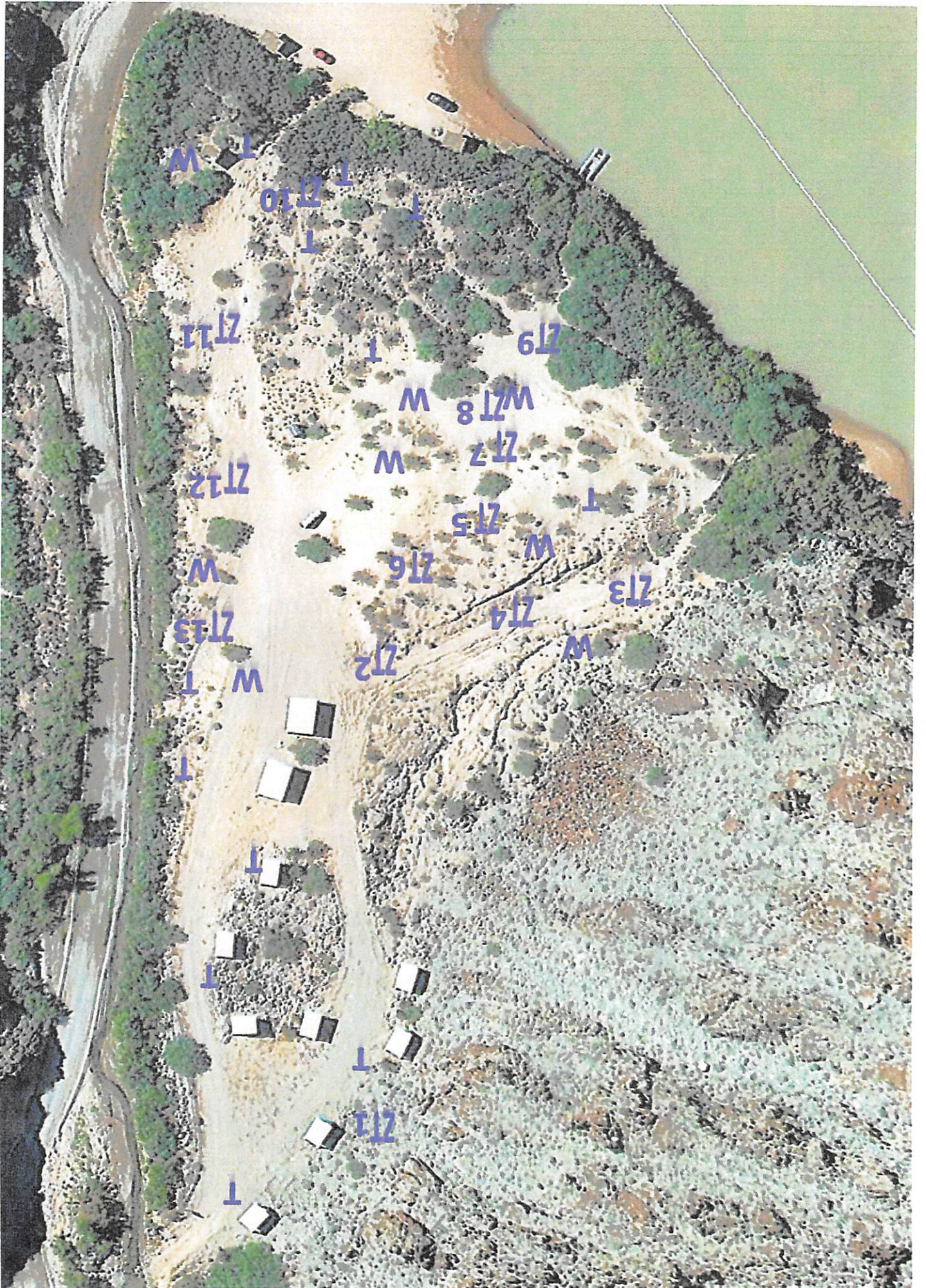


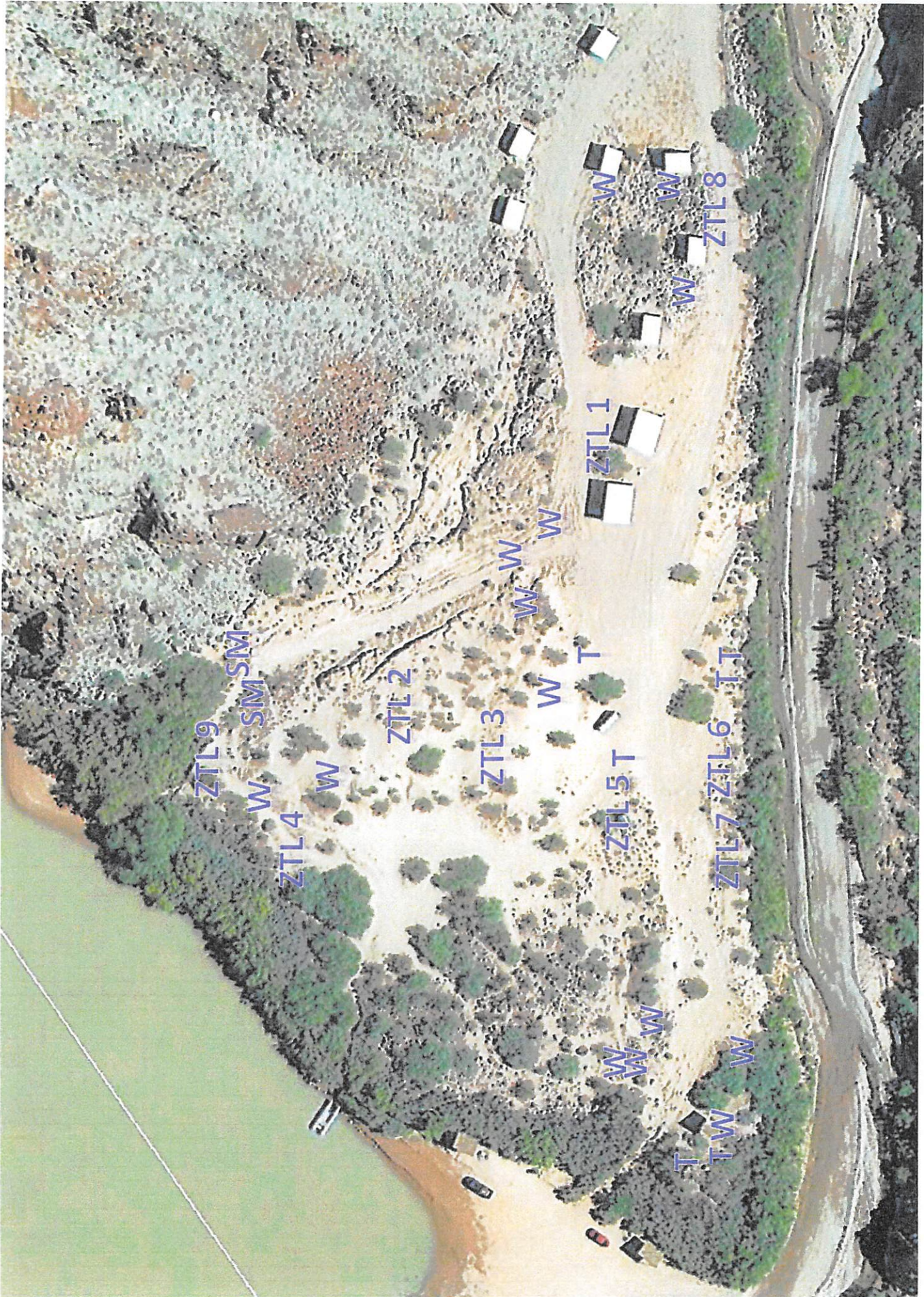
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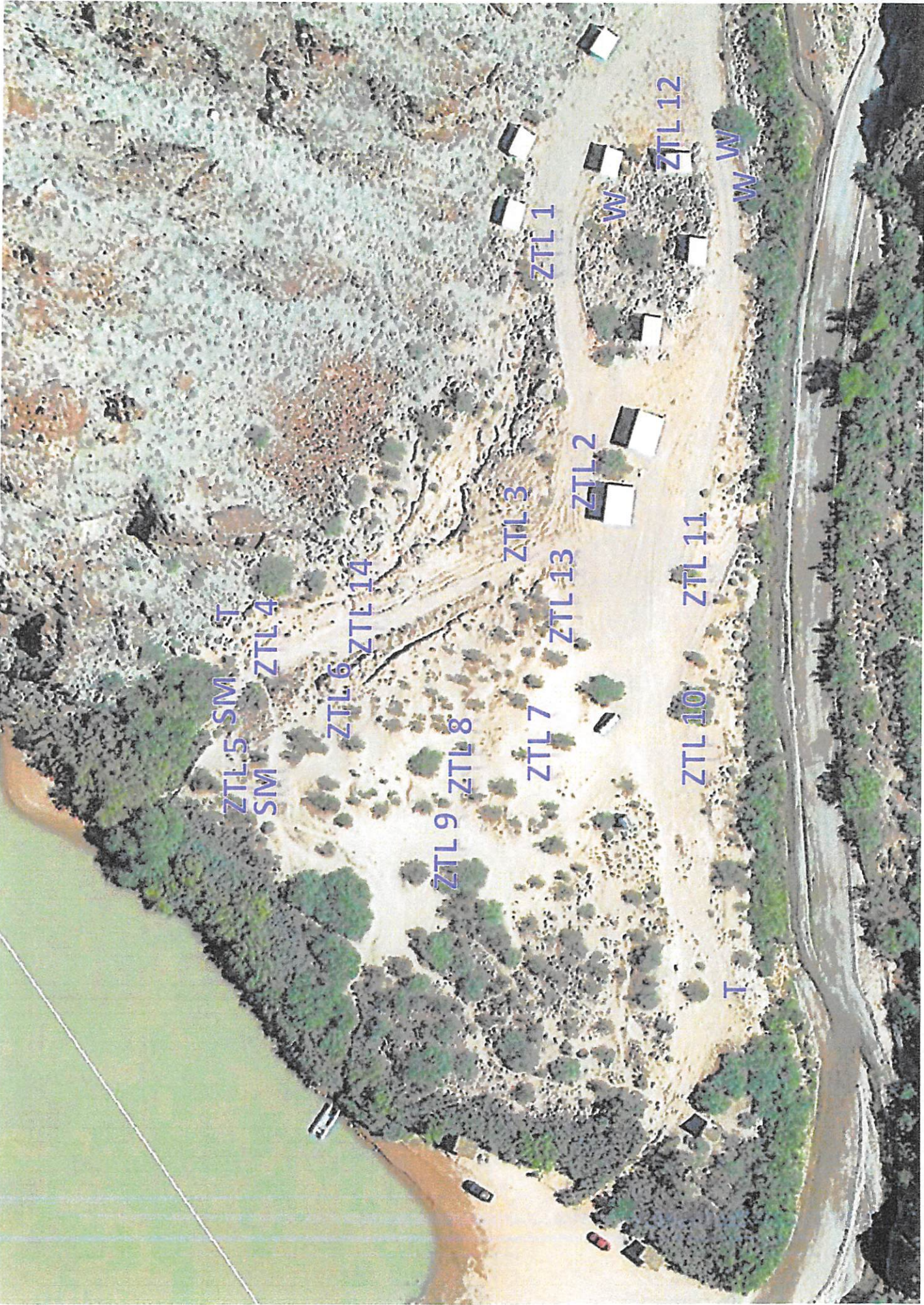
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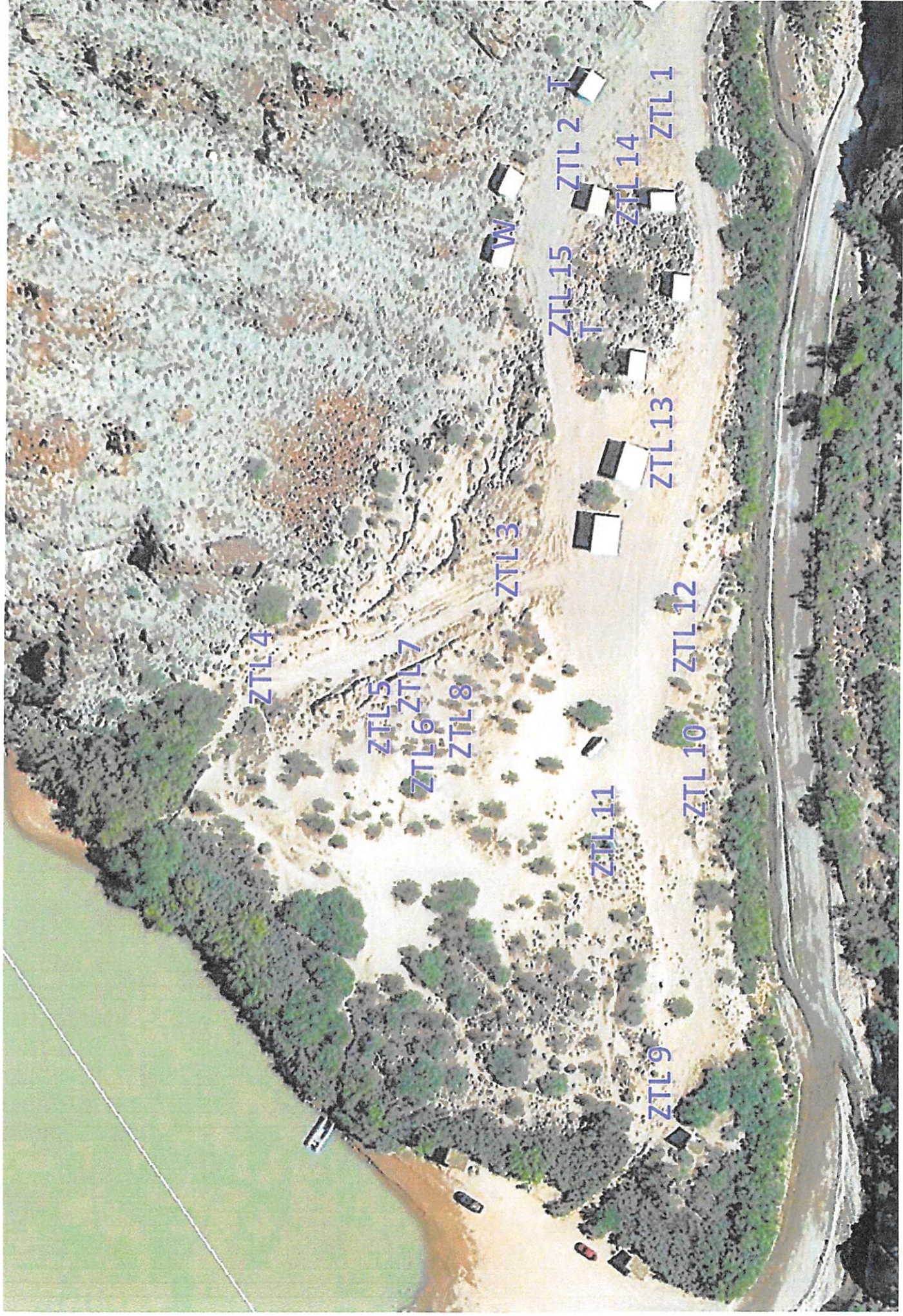




August, 2015



September, 2015



October, 2015