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Desert Tortoise Connectivity Across Roadways

Project Number: 2015-ECOCENT-1580B

Clark County, Nevada

Final Report

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Executive Summary

Clark County Nevada's Multiple Species Habitat Conservation Plan (MSHCP) promotes conservation of protected species and their habitats in order to ensure long-term survival of covered species. The Clark County Desert Conservation Program (DCP), as a representative of Boulder City, Henderson, Las Vegas, North Las Vegas, and the Nevada Department of Transportation, and Clark County, is tasked with maintaining compliance with the MSHCP and the associated Incidental Take Permit (ITP) granted under Section 10(a)(1)(B) of the Endangered Species Act (ESA). The Mojave Desert tortoise (*Gopherus agassizii)* is listed by the United States Fish and Wildlife Service (USFWS) as a threatened species and is designated a covered species under the MSHCP. Since adequate gene flow is paramount for the long-term survival of a species, especially one such as the desert tortoise which faces widespread habitat disruption, gaining an understanding of how to maintain connection between populations separated by anthropogenic features such as highways can contribute to the survival of the species. This project will contribute to that effort by collecting data to estimate tortoise population densities and examine tortoise movement in relation to culverts along portions of US-93 and US-95 north of Las Vegas.

Ecocentric, a Henderson, NV-based biological services company, provided field biologists, GIS staff, and data and project management to successfully complete this project. The study is part of a larger effort by the Clark County Desert Conservation Program, the United States Fish and Wildlife Service, and the Bureau of Land Management (BLM) to gain a better understanding of tortoise population connectivity.

Initially slated for spring 2020, the proposed surveys were delayed until spring 2021 due to COVID-19 restrictions. Fieldwork commenced on March 24, 2021 and was completed on May 16, 2021. The study included surveying 10-meter transects over three rounds on 36 800-meter radius semi-circle plots comprising a total of nearly 26,800 acres. Data was collected for all tortoise and tortoise sign observations. All tortoises were tagged for future identification by downward-facing wildlife cameras previously placed in the culverts. As stipulated in the project contract, adult tortoises encountered in Clark County along Highway 95 were affixed with a radio transmitter for future telemetry and GPS data logger monitoring by Ecocentric for the project *Desert Tortoise Telemetry Around Culverts*. No transmitters were attached to Highway 93 tortoises since that was not a requirement for this work.

Surveyors encountered a total of 183 unique tortoises, 89 of which were recaptured during subsequent survey passes. More than twice as many tortoises were encountered on Highway 93 plots than on Highway 95 plots. Crews observed 2,745 tortoise burrows, 139 tortoise carcasses (five of which had ID tags from previous project), 78 pieces of tortoise scat, 49 piles of tortoise bone/scute fragments, and 13 locations with tortoise eggshells. Recorded tortoise sign on US-93 plots was more than triple that recorded on US-95. Overall, more tortoises and sign were encountered during the surveys than initially estimated.

Section 1.0 – Introduction

1.1 Project Background

Continued development throughout the range of the threatened Mojave Desert tortoise and the subsequent fragmentation of its habitat comprise two of the greatest ongoing threats to the long-term survival of the species. Roads and highways can be especially detrimental to population connectivity and gene flow as they are hazardous for tortoises to cross. In many cases, highways within the tortoise's range are fenced to keep tortoises from entering the roadway. While this measure will protect tortoises from highway fatalities, it does not address the long-term detriment of creating genetically isolated tortoise populations. Culverts, and in particular box culverts, are being proposed as a method to allow for tortoise movement across roadways.

1.2 Project Description

The *Desert Tortoise Connectivity Across Roadways* project (2015-ECOCENT-1580B) collected data on desert tortoise populations along Highways 93 (US-93) and 95 (US-95) in Clark and Nye Counties north of Las Vegas, Nevada. This work was supported by the Clark County DCP and is in coordination with a larger population connectivity study by the U.S. Fish and Wildlife Service and the Bureau of Land Management. Mark-recapture surveys were conducted to help assess desert tortoise population densities near highway culvert crossings and to shed light on the potential effectiveness of culverts as population connectors. This project is part of a larger conservation effort to further implement Clark County's Multiple Species Habitat Conservation Plan (MHSCP), permit #TE034927-0, effective February 1, 2001, and was funded in accordance with Southern Nevada Public Land Management Act (SNPLMA).

One plot on either side of 18 previously established culvert crossings, for a total of 36 plots, was surveyed for desert tortoises and their sign. Eight culverts are located in Clark County along Highway 93 between milepost 57 and milepost 70. Ten culverts are located on Highway 95 in Clark County between mileposts 121 and 132 and from the Nye County line to milepost 6. The plots along both highways were chosen as these are locations where tortoises have access to culverts. In addition, an ongoing effort by USFWS has been underway to monitor tortoise movement across the highways in these locations using downward-facing wildlife cameras placed in the culverts.

For this project, surveys were conducted from March 24 through May 16, 2021. Desert tortoises are generally most active in the spring (April-May) and fall (September-October). Given the cryptic nature of tortoises and how difficult they are to locate, spring and fall are optimal times to survey since crews are more likely to encounter active tortoises outside of burrows during these times.

1.3 Management Actions Addressed (As Identified in the MSHCP)

As outlined in Clark County, Nevada's MSHCP, the County is required to implement conservation actions within the county to mitigate take of protected species. The MSHCP was created to help the County maintain compliance with the Endangered Species Act and the county's Section 10(a)(1)(B) incidental take permit.

Specifically, the MSHCP identifies the following as primary goals: (a) No net unmitigated loss or fragmentation of habitat and (b) Maintain stable or increasing populations of covered species. In addition, the MSHCP will maintain the long-term value of ecosystems in Clark County and provide a balance between allowing incidental take of covered species and the long-term recovery of those species and their habitat.

The desert tortoise is a federally threatened species under the Endangered Species Act and is considered a covered species by the MSHCP. Therefore, the County is required to implement measures to ensure conservation of tortoise populations and their habitat within Clark County. Since this project aims to estimate tortoise population densities along highways and assess the use of culverts as population connectors, it contributes to the completion of goals outlined by the MSHCP.

1.4 Project Goals and Objectives

The project's primary objective was to encounter and mark all desert tortoises located within the 36 plots along Highways 93 and 95. Size, sex, and basic health data were recorded for each encounter. Observed tortoise sign was recorded to contribute to relative abundance estimates and assist with determining population densities near the culvert crossings. An additional objective was to attach radio transmitters on up to 20 adult tortoises encountered on Highway 95 plots within Clark County. These tortoises will be incorporated into the *Desert Tortoise Telemetry Around Culverts* for additional monitoring.

Project data will be used along with data from other ongoing studies to assess rates of tortoise movement across fenced roads. Specifically, by determining the ratio of tortoises utilizing culverts to the estimated tortoise population in the area, this project seeks to shed light on the extent to which degree culverts function as population connectors. Ultimately, this information could provide a better understanding of how to maintain connectivity between desert tortoise populations throughout their habitat.

Section 2.0 – Methods and Materials

2.1 Surveys

Survey protocol was designed by the DCP and outlined in the project Scope of Work. Three rounds of mark-recapture desert tortoise surveys were conducted beginning on March 24, 2021, and ending on May 16, 2021. Teams of two to five fieldworkers surveyed a maximum of 10 hours a day, six days a week. As outlined by the DCP, plots along each highway were treated as distinct groups, primarily to facilitate survey progress by minimizing survey crew travel between highways. In order to survey both areas most efficiently, teams were divided between the two highways. Plots in each round on each highway were surveyed concurrently. Unique random survey orders were generated for Highway 93 and 95 plots separately for each of the three rounds of surveys.

Plots 95-01N and 95-10N were located on Department of Defense (DOD) and Department of Energy (DOE) land, respectively, and required special permission to access. For the DOE plot (95-10N), we scheduled the survey dates with DOE biologists who served as our escorts during the surveys. The three rounds of surveys for 95-01N had to be scheduled with military security at Creech Airforce Base, the entity responsible for managing the land adjacent to the plot. Since the survey dates for these plots had to be scheduled in advance, they were not part of the randomized survey order. The fenced-off portion of plot 95-01N that was on restricted Department of Defense land was not surveyed because the security fence combined with tortoise-exclusion fence would preclude tortoises from being present. Permission was not secured to access the private land within plots 95-02N and 95-02S, and therefore, those portions were not surveyed.

Tables 1 and **2** show the final survey order for each round including the start and end dates. Due to scheduling changes for the DOE and DOD plots and re-scheduling to mitigate risk posed by recreational shooters on Highway 93, the actual survey order deviated from the original survey order proposed in the project's Data Management Plan. These changes were authorized by DCP staff.

Table 1. US-93 Plot Survey Order - Actual

Plot Name	Round One Start Date	Round One End Date	Round Two Start Date	Round Two End Date	Round Three Start Date	Round Three End Date
93-01E	25/Mar	27/Mar	22/Apr	22/Apr	29/Apr	29/Apr
93-01W	31/Mar	2/Apr	9/Apr	10/Apr	22/Apr	22/Apr
93-02E	5/Apr	7/Apr	14/Apr	16/Apr	29/Apr	29/Apr
93-02W	24/Mar	26/Mar	15/Apr	17/Apr	2/May	3/May
93-03E	1/Apr	2/Apr	21/Apr	23/Apr	25/Apr	26/Apr
93-03W	2/Apr	4/Apr	10/Apr	12/Apr	7/May	9/May
93-04E	7/Apr	8/Apr	17/Apr	18/Apr	1/May	2/May
93-04W	31/Mar	2/Apr	11/Apr	12/Apr	1/May	2/May
93-05E	27/Mar	28/Mar	23/Apr	24/Apr	5/May	7/May
93-05W	24/Mar	25/Mar	23/Apr	24/Apr	3/May	5/May
93-06E	4/Apr	4/Apr	12/Apr	14/Apr	3/May	3/May
93-06W	3/Apr	3/Apr	19/Apr	21/Apr	30/Apr	1/May
93-07E	29/Mar	31/Mar	8/Apr	9/Apr	24/Apr	26/Apr
93-07W	4/Apr	5/Apr	17/Apr	19/Apr	28/Apr	28/Apr
93-08E	8/Apr	9/Apr	15/Apr	17/Apr	25/Apr	26/Apr
93-08W	28/Mar	29/Mar	10/Apr	11/Apr	28/Apr	30/Apr

Table 2. US-95 Plot Survey Order - Actual

Plot Name	Round One Start Date	Round One End Date	Round Two Start Date	Round Two End Date	Round Three Start Date	Round Three End Date
95-01N	26/Mar	27/Mar	16/Apr	17/Apr	7/May	8/May
95-01S	27/Mar	29/Mar	16/Apr	18/Apr	8/May	10/May
95-02N	31/Mar	2/Apr	24/Apr	26/Apr	14/May	15/May
95-02S	31/Mar	2/Apr	28/Apr	29/Apr	8/May	9/May
95-03N	7/Apr	8/Apr	26/Apr	28/Apr	9/May	10/May
95-03S	27/Mar	28/Mar	30/Apr	1/May	10/May	10/May
95-04N	24/Mar	25/Mar	12/Apr	14/Apr	12/May	13/May
95-04S	8/Apr	9/Apr	2/May	3/May	12/May	13/May
95-05N	5/Apr	5/Apr	2/May	3/May	12/May	13/May
95-05S	8/Apr	10/Apr	18/Apr	19/Apr	13/May	15/May
95-06N	10/Apr	11/Apr	19/Apr	21/Apr	12/May	13/May
95-06S	29/Mar	29/Mar	14/Apr	16/Apr	6/May	7/May
95-07N	4/Apr	5/Apr	21/Apr	23/Apr	6/May	6/May
95-07S	5/Apr	7/Apr	23/Apr	25/Apr	5/May	6/May
95-08N	25/Mar	26/Mar	23/Apr	24/Apr	13/May	15/May
95-08S	2/Apr	3/Apr	17/Apr	19/Apr	7/May	9/May
95-09N	24/Mar	25/Mar	30/Apr	1/May	16/May	16/May
95-09S	10/Apr	12/Apr	15/Apr	15/Apr	9/May	10/May
95-10N	31/Mar	31/Mar	14/Apr	14/Apr	5/May	5/May
95-10S	2/Apr	4/Apr	16/Apr	17/Apr	7/May	8/May

Plots along Highways 93 and 95 were labeled with a number and cardinal direction (N/S, E/W) indicating side of highway location (**Figures 1** and **2**). Per DCP and USFWS stipulation, each plot was a semicircle with an 800-meter radius and the culvert located at the midpoint along the 1600-meter diameter line. The diameter line of each plot roughly parallels the tortoise fence along the highway. Survey transects were spaced 10 meters apart and numbered 1 through 80, with the first transect located 5 meters off the diameter line (tortoise fence). Surveyors followed transect routes using handheld Garmin Global Positioning System (GPS) units. To achieve 100 percent coverage, surveyors deviated from transects as needed to inspect burrows and shrubs for tortoises.

To minimize opportunities for tortoise movement on or off plot, surveys on any plot were completed within three days of commencement. The second or third rounds of surveys on a given highway would not commence until the previous round of surveys for that highway were completed. Since this was a mark-recapture project, surveys were not conducted once the air temperature reached 95˚F in new shade two inches above the ground.

To achieve the objective of locating and tagging all desert tortoises within the pre-determined plots, some plots required surveys outside of the 10-meter transects in order to cover 100% of the tortoise-accessible area 800 meters from each culvert. For all plots, the 'V'-shaped area on each plot where the tortoise fence bends to meet the culvert opening was surveyed.

In cases where there was a substantial curve in the highway, the affected plot was either aligned to maintain equal distance from each of the diameter-line end points to the fence line (e.g., plots 93-01E, 93-01W) or as in the case of plots 95-01N&S, 95-05N&S, and 95-10N&S, the end points were positioned so the diameter line was parallel with the longest straight section of the fence. If the end points ended up positioned on the highway side of the fence (e.g., 93-01E, 95-10S), the surveys stopped at the tortoise fence, and the subsequent survey area was smaller than an 800-meter-radius semicircle. If the end points were positioned off the fence on the survey side (e.g., 93-01W, 95-10N), the entire semicircle was surveyed, plus the area outside the semicircle between the diameter line and the fence. Refer to **Figure 3** for a visualization of these plots.

667245 672245 677245 682245 687245 692245 697245 702245

4053653 4048653 4043653 4038653 4033653

93-8W 93-8E

93-7W 93-7E

93-6W 93-6E

93-5W 93-5E

93-4W 93-4E

93-3W 93-3E

93-2W 93-2E

93-1W 93-1E

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N
W E
S

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS,

Survey Plot

Diameter Line

0 2,500 5,000
Meters

Figure 1. US-93 Plot Names and Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

588957 593957 598957 603957 608957 613957

4056352 4051352 4046352 4041352

95-10N
95-10S
95-9N
95-9S
95-8N
95-8S
95-7N
95-7S
95-6N
95-6S
95-5N
95-5S
95-4N
95-4S
95-3N
95-3S
95-2N
95-2S
95-1N
95-1S

Source: Esri, DigitalGlobe, GeoEye, Earthstar

N W E S

0 2,500 5,000 Meters

Survey Plot

Diameter Line

Figure 2. US-95 Plot Names and Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

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95-10N
95-10S
Veterans Memorial Hwy
95
Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

95-1N
95-1S
Veterans Memorial Hwy
95
Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

95-5N
95-5S
95-4N
95-4S
Veterans Memorial Hwy
95
Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

93-1W
93-1E
Great Basin Hwy
95
Esri, HERE, Garmin, (c) OpenStreetMap contributors, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N
W
E
S

Survey Plot
Culvert Center, Collected in Field
Diameter Line

0 200 400 800
Meters

Figure 3. Survey Plots on Curved Portion of US-93 & US-95
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

2.2 Data Collection

Data was collected in accordance with the parameters and guidelines outlined in the Clark County *Desert Tortoise Connectivity Across Roadways* contract, the *USFWS Desert Tortoise Field Manual*, and the *USFWS Health Assessment Procedures for the Mojave Desert Tortoise (Gopherus agassizii): A Handbook Pertinent to Translocation*.

Surveyors recorded data for each plot survey event (*Survey Plot)*, tortoise sign observed (*Tortoise Sign)*, and live tortoise encountered (*Tortoise Encounter)* on paper datasheets and corresponding digital forms. Digital records were created within the iForm application by Zerion Software on Android or iOS devices. Spatial data was recorded within iForm and on Garmin GPS handheld devices for tortoise encounters, tortoise sign, and survey progress. All location data was collected using Universal Transverse Mercator (UTM), North American Datum 1983 (NAD83), Zone 11S.

All data were assessed for accuracy during three phases of integration into the final dataset. Prior to uploading electronic data at the end of each day, crews performed a first round of quality control by comparing the paper and electronic data forms and making any necessary corrections. During the integration process, all data was validated for thoroughness, redundancies, likelihood, spatial-temporal precision, and relational integrity. Lastly, a final round of quality control was completed comparing the paper datasheets to the uploaded electronic data. Discrepancies were recorded in a log and corrected in the final MS Access database.

Tortoises and tortoise sign encountered outside of designated surveys (i.e., when not actively walking transects) were recorded as incidental observations. The same data was collected for all tortoise and sign encounters, even if incidental.

2.2.1 Survey Plot Data

Survey plot data included plot ID; date; survey round; crew members; number of tortoises encountered; start and end times and temperatures; and an indication of whether the plot was completed. Additionally, the start point of the first transect and the end point of the last transect was collected within iForm and on handheld Garmin GPS devices. These data were used to monitor survey progress.

2.2.2 Tortoise Encounter Data

During mark-recapture surveys, recording the initial and each subsequent encounter is vital to achieve accurate density estimates. To do so, all tortoises on this project were extracted from burrows upon the first encounter or during subsequent encounters if they were not able to be identified. Every effort was made during all tortoise encounters to minimize stress to tortoises. Tortoise IDs were selected from a predetermined set from the County and assigned to each tortoise during the initial encounter. For each initial and subsequent tortoise encounter, fieldworkers recorded location in UTM NAD83, plot ID, date, tortoise ID(s), time, survey round, fieldworker name, temperature, tortoise location in the environment, cloud cover, and an indication of whether the encounter was incidental or not.

For the initial encounter only, midline carapace length (MCL), mass, sex, and general health data including attitude, respiration, naris and eye discharge, and BCS were collected. For subsequent encounters, tortoises were only extracted from burrows if they could not be identified by viewing their ID tag or paint-pen markings. Handling of tortoises only took place when necessary for data collection.

Photographs were taken within iForm using Android or iOS mobile devices with a minimum resolution of 12 megapixels. A photograph of the face and carapace with the ID tag visible was taken for all initial encounters. A photo of the eyes was only taken if discharge was present. Photos of the face and carapace can serve as a baseline record of each tortoise's condition. In addition, the carapace photos can help identify tortoises during future encounters, even for potential upcoming projects, should the tag become illegible. Photos of any eye or naris discharge present can be used to validate results if needed.

2.2.3 Tortoise Sign Data

Tortoise sign data will be used by the DCP to calculate relative abundance on the plots. Location in UTM NAD83, plot ID, date, survey round, and fieldworker were collected on all tortoise sign observed including burrows, newly encountered carcasses, scat, tracks, bone/scute fragments, and eggs or eggshell fragments.

Burrows were recorded each time they were encountered, even if recorded during a previous round. All tortoise burrows encountered were classified following the condition classes outlined in the USFWS *Desert Tortoise Field Manual*:

1. currently active, with desert tortoise or recent desert tortoise sign
2. good condition; definitely desert tortoise; no evidence of recent use
3. deteriorated condition, which includes collapsed burrows; definitely desert tortoise
4. good condition; possibly desert tortoise
5. deteriorated condition, which includes collapsed burrows; possibly desert tortoise

Newly encountered tortoises in burrows were extracted and assigned an ID that was recorded on the *Tortoise Sign* data sheet. IDs of previously encountered tortoises in burrows were recorded as well. Carcasses with or without previously assigned IDs, were only recorded on the first encounter. Tortoise scat was marked as "this year" if it had a sheen and was dark in color. All other scat was recorded as "not this year". A carcass was recorded as "bone/scute fragments" if less than 25% of the carcass was present.

2.3 Tortoise Handling and Extraction

All desert tortoises were handled in accordance with USFWS guidelines to ensure minimal risk to the animals. Tortoises encountered for the first time during the surveys were extracted from burrows only if necessary and tagged with unique identification numbers by covering a paper ID with clear epoxy on the 1st, 2nd, or 3rd vertebral scute. The tag was positioned so that it would be visible from downward-facing cameras placed in the culverts.

To facilitate identification without removing tortoises from burrows during repeat encounters, water-based white paint pens were used to mark the ID number on an anterior and posterior carapacial scute.

In keeping with standard practice and given the severity of drought conditions within recent months, team members took measures to avoid exacerbating tortoise dehydration. If a tortoise voided its bladder during handling, non-invasive rehydration was attempted by offering clean drinking water from a sterile needless syringe. Tortoises were offered at least 40 milliliters (ml) of water per kilogram (kg) body weight with a minimum of 15 ml offered regardless of body weight.

2.4 Transmitter Attachment and Continued Monitoring of US-95 Residents

The DCP and USFWS previously identified the plots located in Clark County along Highway 95 as suitable recipient sites for tortoises to be translocated from development sites in the county. Up to 20 translocated tortoises will receive a radio transmitter and GPS data logger and be incorporated into the *Desert Tortoise Telemetry Around Culverts* project, which aims to further improve our understanding of tortoise movement in relation to highway culverts. To add resident tortoises to the *Telemetry Around Culverts* project for comparison purposes, adult tortoises (MCL 180mm or greater) encountered during surveys along Highway 95 plots within Clark County (95-01 through 95-07) received a temporary transmitter attachment. These resident tortoises were then added to the *Telemetry* study and received a permanent transmitter and GPS logger attachment.

Section 3.0 – Results and Evidence of the Results

3.1 Plot Surveys

We were able to complete the three rounds of surveys on all 36 plots during the spring 2021 season. Twenty plots on US-95 and 16 plots on US-93 were each surveyed three times, for a total of 108 plot survey events. The Highway 93 surveys comprised a total of approximately 4,785 kilometers of transects over nearly 11,900 acres. For the plots on Highway 95, crews walked roughly 5,980 kilometers on approximately 14,880 acres. Crews averaged about 10 miles per day, covering less ground on plots with a higher tortoise density and more on plots with sparse tortoise sign. In total, crews walked approximately 10,800 kilometers of transects covering nearly 26,800 acres.

As specified in the project guidelines, each plot survey event was completed within three days of survey commencement. Due to steep, unwalkable terrain, 100% coverage was not achieved on plots 93-03E, 93-04E, 93-07W, and 93-08W. Where possible on these plots, crews conducted informal surveys of terrain that was safely walkable but not easily surveyed by following transects.

During the first round of surveys, it was discovered that the culvert opening for plots 95-02N and 95-02S was closed off, with tortoise fencing rendering the culvert inaccessible to tortoise movement. Upon bringing this to the attention of the County, we were informed this closure was due to a previous tortoise fatality potentially caused by rip-wrap at the culvert opening. We were instructed to complete the three rounds of surveys on those plots regardless of the culvert's inaccessibility.

Firearm discharge from public target practice was frequent along the Highway 93. Due to firearm discharge into plots 93-01W, 93-01E, and 93-02E, Clark County staff assisted in temporarily blocking access to shooting areas to allow surveys to proceed safely.

3.2 Tortoise Encounters

A total of 272 tortoises were encountered during the three rounds of surveys. Of these, 183 were unique initial observations, and 89 were recaptures. Six tortoises were encountered incidentally outside of formal surveying. Fifty-one tortoises encountered were female, 47 were male, and 85 were less than 180mm MCL and therefore categorized as of unknown sex. Surveyors were unable to extract one tortoise from a burrow on plot 95-10S; although not tagged, this tortoise was visible and determined to be a female over 180mm MCL. Another tortoise on plot 93-07E was not extracted or tagged but determined to be under 180mm MCL and therefore of unknown sex. (**Table 3**)

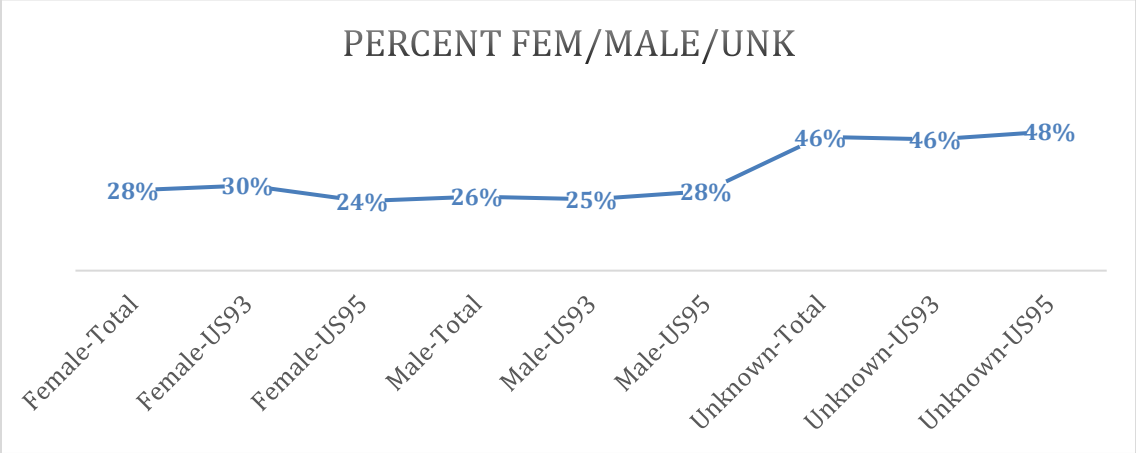
Table 3. Tortoise Encounter Summary per Plot

Plot ID	Unique Encounters	Recaptures	Incidental Encounters	Female	Male	Unknown	MCL <180mm	MCL ≥180mm	Total Encounters
93-01E	20	7	0	5	6	9	9	11	**27**
93-01W	10	1	0	3	1	6	6	4	**11**
93-02E	9	5	2	4	1	4	4	5	**14**
93-02W	15	17	0	6	6	3	3	12	**32**
93-03E	0	0	0	0	0	0	0	0	**0**
93-03W	0	0	0	0	0	0	0	0	**0**
93-04E	7	2	0	4	0	3	3	4	**9**
93-04W	0	0	0	0	0	0	0	0	**0**
93-05E	0	0	0	0	0	0	0	0	**0**
93-05W	1	0	0	0	0	1	1	0	**1**
93-06E	2	0	0	1	0	1	1	1	**2**
93-06W	0	0	0	0	0	0	0	0	**0**
93-07E	17	10	0	4	4	9	9	8	**27**
93-07W	9	3	1	3	4	2	2	7	**12**
93-08E	21	10	0	4	6	11	11	10	**31**
93-08W	14	4	0	3	3	8	8	6	**18**
US-93 Sub-Total	**125**	**59**	**3**	**37**	**31**	**57**	**57**	**68**	**184**
US-93 % of Grand Total	**68%**	**66%**	**50%**	**74%**	**66%**	**67%**	**67%**	**70%**	**68%**
95-01N	0	0	0	0	0	0	0	0	**0**
95-01S	3	0	0	1	0	2	2	1	**3**
95-02N	0	0	0	0	0	0	0	0	**0**
95-02S	0	0	0	0	0	0	0	0	**0**
95-03N	0	0	0	0	0	0	0	0	**0**
95-03S	2	0	0	1	0	1	1	1	**2**
95-04N	0	0	0	0	0	0	0	0	**0**
95-04S	3	2	0	0	1	2	2	1	**5**
95-05N	1	1	0	0	0	1	1	0	**2**
95-05S	7	3	0	1	1	5	5	2	**10**
95-06N	1	0	0	0	1	0	0	1	**1**
95-06S	6	3	1	1	2	3	3	3	**9**
95-07N	1	1	2	0	1	0	0	1	**2**
95-07S	8	6	0	2	2	4	4	4	**14**
95-08N	0	0	0	0	0	0	0	0	**0**
95-08S	10	3	0	3	1	6	6	4	**13**
95-09N	0	1	0	0	0	0	0	0	**1**
95-09S	7	6	0	1	3	3	3	4	**13**
95-10N	2	2	0	1	0	1	1	1	**4**
95-10S	7	2	0	2	4	0	0	6	**9**
US-95 Sub-Total	**58**	**30**	**3**	**14**	**16**	**28**	**28**	**30**	**88**
US-95 % of Grand Total	**32%**	**34%**	**50%**	**26%**	**34%**	**33%**	**33%**	**30%**	**32%**
Grand Total	**183**	**89**	**6**	**51**	**47**	**85**	**85**	**98**	**272**

3.2.1 Sex Distribution

Sex determination in desert tortoises is made when tortoises reach a length of 180mm MCL or greater. Males typically have a concave plastron, longer tales, longer gulars, and pronounced chin glands while females will have flat plastrons, short button-like tales, and longer hindlimb nails. Of the 183 unique tortoises encountered across all rounds and all plots, 28% were female, 26% were male, and 46% were of unknown sex, being less than 180 MCL in length. **Figure 4** illustrates the percentage of male, female, and unknown sex tortoises as a portion of total unique encounters. The percentage of each sex classification compared to each Highway's distinct total is also shown.

Figure 4. Percentage of Female, Male, Unknown Sex Tortoises



3.2.2 Health Summary

Health is a vital component to the survival of a species. There are several factors that can contribute to decreased health in individual animals and entire populations. One of the threats facing the desert tortoise is the prevalence of upper respiratory tract disease (URTD) caused by the bacteria *Mycoplasma agassizii* and *Mycoplasma testudineum*. Another is illness resulting from herpesvirus infection. Trauma from predators and human interactions can also have a negative impact on tortoise survival. Lastly, drought conditions and subsequent diminished forage can also lead to poor health in a population. Per the project Scope of Work, we did a general assessment of health by observing the animal's behavior, respiration, body condition score (BCS), a metric of general health, noting any trauma, and recording any clinical signs of disease such as naris or eye discharge. Health observations were only recorded during initial encounters. To avoid causing excessive stress, forelimbs were not extracted on tightly withdrawn animals to acquire BCS and naris/eye observations.

Table 3 provides a summary of health observations made during initial encounters. One tortoise on each highway is not included as they were unable to be extracted. Of the 183 initial encounters, BCS was recorded on 94; attitude, respiration, and trauma were noted on all but the two un-extracted animals; and naris and eye observations were made on 130 and 117 animals, respectively. Of the observed animals, 35% had a BCS of 3, 59% had a BCS of 4, and the remaining 6% were divided equally between BCS 1, 2, and 5. As noted in the table, only a few animals observed had any trauma or clinical sign of disease.

Table 3. Health Data Summary

	BCS 1	BCS 2	BCS 3	BCS 4	BCS 5	Lethargic/ Weak	Abnormal Respiration	Naris Occlusion	Naris Discharge	Eye Discharge	Severe Trauma
US-93	1	2	19	32	2	0	1	5	2	2	1
US-95	1	0	14	23	0	1	0	1	0	0	0

3.2.3 Highway Crossings

As noted above, tortoise encounter data was collected in part to investigate the possible role of culverts in facilitating safe passage across roadways. During surveys, two tortoises were noted to have moved from one side of the highway to the other. On May 9, CC0467 (male, MCL 187mm) was initially encountered inside the culvert on the south side of the highway on plot 95-09S. On May 16, CC0467 was again located inside the same culvert but on the north side of the highway on plot 95-09N. CC0477 (male, MCL 222mm), initially encountered on plot 95-07N on April 5 on the north side of US-95, was located the following week on plot 95-07S on the south side of the highway, 1.3 kilometers (km) from its previous location during a telemetry observation for the *Desert Tortoise Telemetry Around* Culverts project. Of note, this tortoise remained on the south side of the highway in the same general area until it was encountered on July 2, 2021, on the north side during a weekly telemetry observation. The movement of CC0467 and CC0477 suggests that tortoises use culverts, at least upon occasion, to cross highways. Ideally, long-term data collected from further telemetry encounters and GPS data loggers, in addition to observations of tortoise movement made by wildlife cameras in the culverts, will serve to refine our understanding of tortoise movement in relation to the culverts.

Appendix A – Tortoise Status summarizes details for each tortoise encountered during the surveys. The tortoise ID is one selected from the list provided by the County for this project. Alternate IDs are any identification numbers already on the tortoise when first encountered. Sex is listed as "unknown" if the tortoise measured less than 180mm MCL. BCS, naris discharge, and eye discharge were only recorded if the tortoise's head was easily visible. To minimize stress on an animal, these data were not recorded in cases where a tortoise's forelimbs were tightly withdrawn during handling. Clinical signs of disease were marked as "yes" or "no" and included tortoise behavior, respiration, and naris or eye discharge. Two tortoises in the table, 'Unknown-95.1' and 'Unknown-93.1', were confirmed to be present but unable to be extracted. Although not tagged or assessed, a sex and size determination was made for both.

3.3 Tortoise Sign

Ample tortoise sign was recorded during this project. As expected, burrow encounters were the most substantial. Surprisingly, crews found more carcasses than scat. Carcass encounters overall were somewhat higher than expected. The lower number of egg/eggshell and bone/scute fragment encounters are consistent with expectations.

A total of 2,745 burrows were recorded during the three rounds of surveys across all class types. Of those, 175 were occupied by tortoises, two of which were not able to be extracted and tagged. Compared to the grand total, 78% of burrow encounters (2,152) were encountered on Highway 93 plots. **Table 5** indicates the number of each class of burrow encountered on each plot as well as the quantity of tortoise-occupied burrows. For comparison, the overall total is given for the burrows encountered on each plot and for each class type. Sub-totals and the percentage of burrows located on each highway compared to the project grand total are noted.

Table 5. Tortoise Burrow Summary per Plot

Plot ID	Class 1	Class 2	Class 3	Class 4	Class 5	Tortoise Occupied	Total
93-01E	53	171	97	0	0	15	**321**
93-01W	29	111	94	4	0	6	**238**
93-02E	35	120	49	3	0	10	**207**
93-02W	27	159	93	0	0	11	**279**
93-03E	0	0	4	2	3	0	**9**
93-03W	0	3	8	11	2	0	**24**
93-04E	12	30	9	1	1	4	**53**
93-04W	0	1	2	19	7	0	**29**
93-05E	0	0	0	0	0	0	**0**
93-05W	0	0	0	0	0	0	**0**
93-06E	4	12	15	1	1	2	**33**
93-06W	2	6	7	2	0	0	**17**
93-07E	51	137	86	1	0	23	**275**
93-07W	17	75	45	4	7	9	**148**
93-08E	48	110	70	9	0	25	**237**
93-08W	30	152	100	0	0	10	**282**
US-93 Sub-Total	**308**	**1087**	**679**	**57**	**21**	**115**	**2152**
US-93 % of Grand Total	**76%**	**80%**	**78%**	**67%**	**81%**	**66%**	**78%**
95-01N	0	0	0	1	0	0	**1**
95-01S	3	18	18	0	1	3	**40**
95-02N	0	0	0	0	0	0	**0**
95-02S	0	0	0	0	0	0	**0**
95-03N	0	0	1	0	0	0	**1**
95-03S	3	5	8	5	0	2	**21**
95-04N	0	0	1	0	4	0	**5**
95-04S	6	2	0	0	0	5	**8**
95-05N	2	2	1	0	0	2	**5**
95-05S	15	44	33	2	0	7	**94**
95-06N	2	13	10	1	0	0	**26**
95-06S	6	19	9	4	0	6	**38**
95-07N	1	2	3	0	0	0	**6**
95-07S	16	29	21	1	0	11	**67**
95-08N	0	2	1	4	0	0	**7**
95-08S	14	58	44	1	0	11	**117**
95-09N	0	0	0	4	0	0	**4**
95-09S	17	24	22	1	0	8	**64**
95-10N	4	9	5	4	0	1	**22**
95-10S	9	46	12	0	0	4	**67**
US-95 Sub-Total	**98**	**273**	**189**	**28**	**5**	**60**	**593**
US-95 % of Grand Total	**24%**	**20%**	**22%**	**33%**	**19%**	**34%**	**22%**
Grand Total	**406**	**1360**	**868**	**85**	**26**	**175**	**2745**

Table 6 outlines observed tortoise sign (excluding burrows) recorded on each plot. Five previously marked and 134 unmarked carcasses were encountered during the three rounds of surveys. Four of the tagged carcasses were found on plot 93-01E and marked as follows: 9012, DL9068, DL9069, and FW-6478. The marked carcass on plot 93-07E only had epoxy notches on the second and fourth right marginals. Seventy-eight total pieces of tortoise scat were found during surveys, 15 from this year. A total of 13 eggshell and 49 bone/scute fragment unique encounters were recorded.

Table 6. Tortoise Sign (Non-Burrow) Summary per Plot

Plot ID	Carcasses	Bone/Scute Fragments	Scat (This Year)	Scat (Not This Year)	Eggshells	Total
93-01E	23	7	2	2	1	**35**
93-01W	12	5	1	2	0	**20**
93-02E	5	1	0	2	0	**8**
93-02W	3	8	6	5	2	**24**
93-03E	1	0	0	0	1	**2**
93-03W	2	0	0	0	0	**2**
93-04E	0	0	1	2	0	**3**
93-04W	0	0	0	0	0	**0**
93-05E	0	0	0	0	0	**0**
93-05W	0	0	0	0	0	**0**
93-06E	8	0	0	12	0	**20**
93-06W	4	1	0	2	0	**7**
93-07E	6	1	0	8	2	**17**
93-07W	2	0	1	4	1	**8**
93-08E	8	0	2	6	2	**18**
93-08W	9	3	0	5	3	**20**
US-93 Sub-Total	**83**	**26**	**13**	**50**	**12**	**184**
US-93 % of Grand Total	**60%**	**53%**	**87%**	**79%**	**92%**	**66%**
95-01N	0	0	0	0	0	**0**
95-01S	2	0	0	1	0	**3**
95-02N	0	0	0	0	0	**0**
95-02S	0	2	0	0	0	**2**
95-03N	0	0	0	0	0	**0**
95-03S	4	0	0	0	0	**4**
95-04N	0	0	0	0	0	**0**
95-04S	3	2	0	0	0	**5**
95-05N	1	0	0	1	0	**2**
95-05S	7	4	0	0	0	**11**
95-06N	2	0	0	1	0	**3**
95-06S	3	0	0	2	0	**5**
95-07N	1	4	0	0	0	**5**
95-07S	0	0	0	0	0	**0**
95-08N	0	3	0	0	0	**3**
95-08S	16	5	1	2	1	**25**
95-09N	1	1	0	0	0	**2**
95-09S	3	1	0	5	0	**9**
95-10N	3	1	0	1	0	**5**
95-10S	10	0	1	0	0	**11**
US-95 Sub-Total	**56**	**23**	**2**	**13**	**1**	**95**
US-95 % of Grand Total	**40%**	**47%**	**13%**	**21%**	**8%**	**34%**
Total	**139**	**49**	**15**	**63**	**13**	**279**

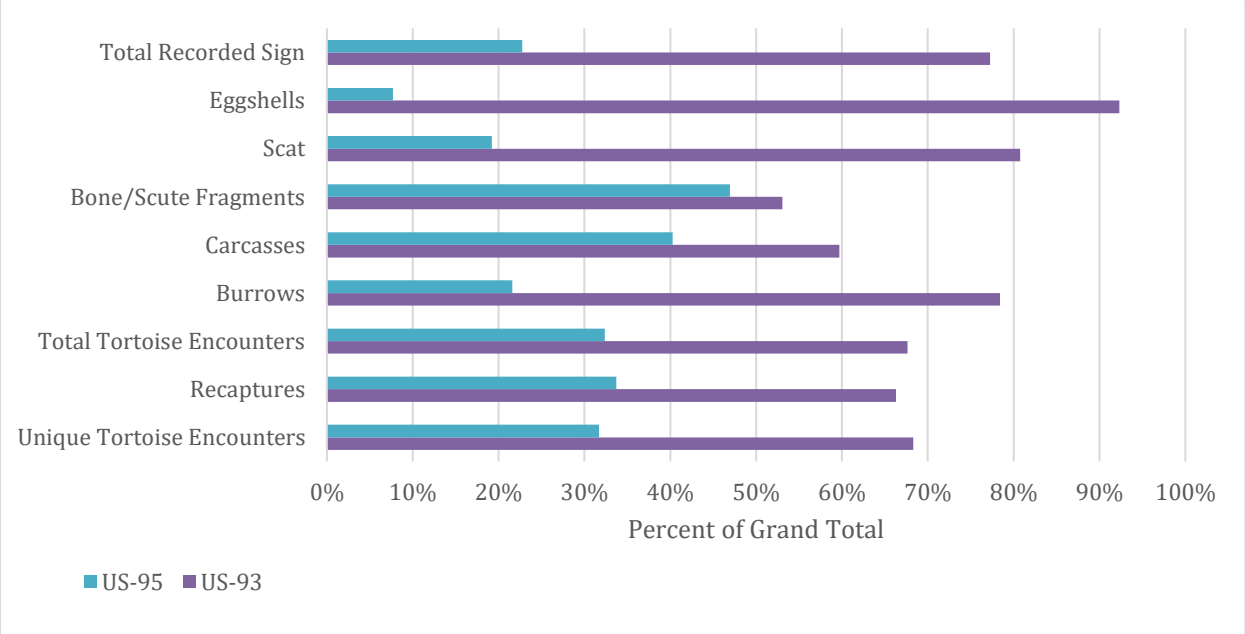
Appendix B, **Figures 7** through **14**, show locations for all initial and recapture tortoise encounters and all tortoise sign for the 16 plots along Highway 93. Tortoise encounter and sign locations for the 20 Highway 95 plots can be found in **Appendix C**, **Figures 15** through **24**. On each map, tortoise sex is indicated, as well as the round in which the encounter occurred. Tortoise IDs in black denote initial encounters, while those in red signify recaptures.

Section 4.0 – Evaluation and Discussion of Results

The purpose of this project was twofold: to collect data to assist with determining desert tortoise population densities near highway culverts and to determine the number of observed highway crossings per estimated tortoises in the area. It was beyond the scope of this project to perform relative abundance or density calculations. However, general trends were noted and are outlined below.

Although habitat characteristics of the two survey areas were similar, Highway 93 had more recorded tortoise encounters and tortoise sign than Highway 95. In total, the US-93 plots had more than double the tortoise encounters (184 vs. 88) and over three times more recorded tortoise sign (2336 vs. 688) than the Highway 95 plots. **Figure 5** shows a comparison of each highway of the different types of sign, tortoise encounters (initial vs. recapture), and sub-totals as a percentage of the grand total.

Figure 5. Comparison of US-93 and US-95 Tortoise Encounters and Sign



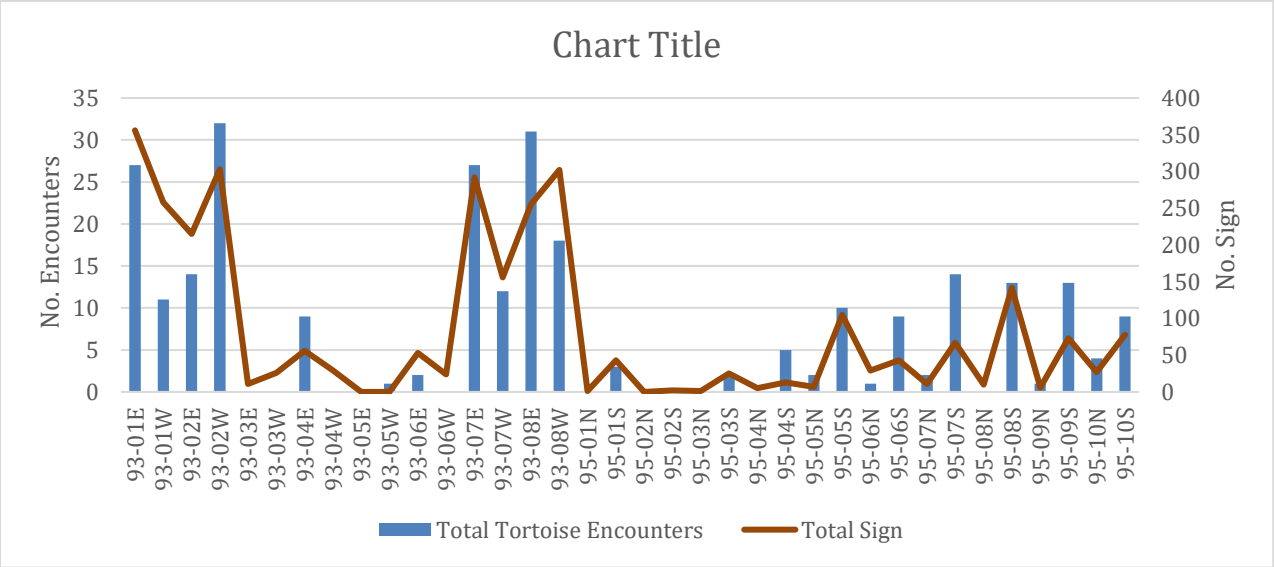
Substantially more tortoises were encountered overall than initially anticipated, particularly along Highway 93. We also did not expect the disparity in tortoise and sign density between the two highways. Initially, we had suspected findings would be similar between the two highways. Individual plot density was also higher than expected for some plots: five plots on US-93 had 15 or more encounters. Given the proximity to the highways, we had assumed plot density would be lower. Further investigation is required to identify the reasons for these differences, but we suspect the variation could be due to changes in substrate and vegetation.

Overall, most animals observed along the two highways were healthy, and there appears to be no significant difference in general health between the two populations. Only 13 animals were recorded as having trauma or any clinical sign of disease. That said, nearly 40% of tortoises whose BCS was recorded were classified as under condition (BCS 1-3). This is most likely due to diminished availability of forage and water because of recent drought conditions. While a low BCS may not signify a significant health issue in the short-term, these animals' survival could be in jeopardy if the drought continues.

It is not surprising that the two cases of movement through culverts were recorded along Highway 95. While traffic is similar on both, the round culverts along Highway 93 may be more difficult to access or less inviting due to their smaller size. They are also darker, only allowing light to enter from either end. Some of the culverts along US-95 are also open in the median, allowing more light to enter. Even though Highway 95 has a large median and is more than double the width of Highway 93, with four lanes compared to two on Highway 93, the larger box-style concrete culverts may be more noticeable and appealing due to their size.

As would be expected, plots with more tortoise sign yielded more tortoise encounters. **Figure 6** charts total tortoise encounters (initial and recaptures) against all tortoise sign recorded (burrows, carcasses, etc.) for each plot.

Figure 6. Total Tortoise Encounter and Tortoise Sign Records per Plot



Of the ten highest-density plots, where eight or more tortoises were encountered, eight are located along Highway 93. Tortoise encounters on US-93 were concentrated within plots on either side of the two southern-most and two northern-most culverts (93-01, 93-02, 93-07, 93-08) where 115 of the 125 (92%) initial tortoise encounters occurred. Four of the central plots had zero tortoise encounters, three had one tortoise encounter each, and one plot, 93-04E, had seven initial tortoise encounters. We believe this difference is due to disparity in habitat quality. Some of the center plots were lower and would be prone to flooding during heavy rain events. Additionally, a couple of the middle plots had experienced fire damage in the past.

On Highway 95, 53 out of 58 (91%) total initial tortoise encounters were in the 10 southern plots. Of those, only plot 95-02S had zero encounters. Three of the northern plots had one tortoise encounter each and one northern plot had two tortoise encounters. Highway 95 encounters were also concentrated on the western plots around culverts 5-10, where 86% of tortoises were located. The reason for the concentration south of the highway is unclear. Although three tortoises were encountered on plot 95-01S, fewer tortoises were encountered on plots around Culverts One and Two, likely due to their proximity to Indian Springs, Creech Airforce Base, and Cactus Springs.

In summary, more tortoises and sign were observed along Highway 93 plots, where tortoises were concentrated on the northern and southern plots. Tortoises along Highway 95 were concentrated on southern plots along the western half. Two tortoises crossing the highway were noted along Highway 95.

Section 5.0 – Conclusion

Ecocentric biologists accomplished the primary objective of this project: to locate and mark all desert tortoises on the 36 plots located on either side of 18 culverts along Highways 93 and 95 north of Las Vegas, Nevada. In addition, observed tortoise sign was recorded, which will be used in future analysis to determine relative abundance estimates. These data can be employed by the County, U.S. Fish and Wildlife Service, and the Bureau of Land Management to contribute to their ongoing efforts to gain a better understanding of tortoise population connectivity throughout the range.

The additional objective of attaching transmitters on up to 20 resident adult tortoises on Highway 95 plots in Clark County was also accomplished. At project end, 14 tortoises received radio transmitters and were incorporated into the *Desert Tortoise Telemetry Around Culverts* project.

Section 6.0 – Recommendations

It would be worthwhile to examine factors that may contribute to differences in density of populations between Highways 93 and 95 such as topography, vegetation, soil characteristics, highway noise, and annual precipitation. Future studies might also examine variables that influence tortoise movement through or near culverts such as culvert type, vegetation cover near culverts, or ease of accessing culvert entrances. These data could inform design and placement of culverts in tortoise habitat and increase safety for animals utilizing the crossings.

Due to the limitations of currently available telemetry tools, this project focused on adult tortoises. Commercial GPS data loggers currently available are too large for placement on sub-180mm MCL tortoises. However, additional telemetry studies focusing on juvenile/immature/sub-adult tortoise movement in relationship to culverts would also be Informative. As technology improves and logger size decreases, it may be possible to place units on sub-adult or immature tortoises to gain more detailed information on their movement in relation to culverts.

References

Clark County Department of Air Quality. (2000). *Final Clark County Multiple Species Habitat Conservation Plan and Environmental Impact Statement for Issuance of a Permit to Allow Incidental Take of 79 Species in Clark County, Nevada*. Clark County Desert Conservation Program.

U.S. Fish and Wildlife Service. (2011). *Desert Tortoise Field Manual*. Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service, Reno, Nevada.

U.S. Fish and Wildlife Service. (2013). *Health assessment procedures for the Mojave desert tortoise (Gopherus agassizii): a handbook pertinent to translocatio*n. Desert Tortoise Recovery Office, U.S. Fish and Wildlife Service, Reno, Nevada.

Appendix A – Tortoise Status Table

Tortoise ID	Initial Encounter Date	Plot ID	Alternate Tortoise ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0343	31/Mar/2021	93-07E		1	1	Male	306	4400	4	Right Naris serous discharge
CC0344	31/Mar/2021	93-07E		2	1, 2	Male	308	3900	4	None
CC0345	31/Mar/2021	93-07E		2	1, 2	Female	247	2450		None observed but assessment limited
CC0346	2/Apr/2021	93-01W		1	1	Unknown	159	825		None
CC0347	4/Apr/2021	93-06E		1	1	Unknown	130	400		None
CC0348	5/Apr/2021	93-07W		1	1	Female	198	1350	4	None
CC0349	5/Apr/2021	93-07W		1	1	Unknown	97	125	4	None
CC0350	5/Apr/2021	93-02E		3	1, 2, 3	Female	263	2850	3	Left Eye serous discharge, Right Eye serous discharge
CC0351	7/Apr/2021	93-02E		1	1	Female	238	2450		None observed but assessment limited
CC0352	7/Apr/2021	93-04E		1	1	Unknown	155	600	3	None
CC0353	8/Apr/2021	93-07E		1	2	Unknown	94	125	3	None
CC0354	9/Apr/2021	93-08E		1	1	Female	246	1875		None observed but assessment limited
CC0355	10/Apr/2021	93-08W		1	2	Female	232	1825		None observed but assessment limited
CC0356	10/Apr/2021	93-08W		2	2, 3	Male	243	2300		None observed but assessment limited
CC0357	10/Apr/2021	93-08W		1	2	Female	272	3450		None observed but assessment limited
CC0358	15/Apr/2021	95-06S		2	2, 3	Unknown	179	1000	3	None
CC0359	15/Apr/2021	95-06S		2	2, 3	Female	183	975		None observed but assessment limited
CC0360	16/Apr/2021	95-06S		1	2	Male	238	2100	3	None
CC0361	18/Apr/2021	95-05S		1	2	Unknown	120	250		None
CC0362	22/Apr/2021	93-01E	ILLEGIBLE	2	2, 3	Female	256	2750		None
CC0363	22/Apr/2021	93-01E	DL9138	1	2	Female	202	1500		None
CC0364	25/Apr/2021	95-07S		1	2	Unknown	129	300	4	None
CC0365	25/Apr/2021	95-07S		1	2	Female	235	2400	3	None
CC0366	25/Apr/2021	95-07S		1	2	Unknown	132	325	3	None
CC0367	17/Apr/2021	93-08E		1	2	Male	296	3750	4	None
CC0368	18/Apr/2021	93-07W		1	2	Male	218	1640		None
CC0369	19/Apr/2021	93-07W		1	2	Unknown	176	1050		Assessment not possible
CC0370	22/Apr/2021	93-01W		1	3	Unknown	113	220	3	None
CC0371	22/Apr/2021	93-01W		1	3	Unknown	126	250	2	None
CC0372	22/Apr/2021	93-01W		1	3	Unknown	123	340	3	None

Tortoise ID	Initial Encounter Date	Plot ID	Alternate Tortoise ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0373	22/Apr/2021	93-01W		1	3	Unknown	123	350		None
CC0374	28/Mar/2021	95-03S		1	1	Unknown	60	30	3	None
CC0375	29/Mar/2021	95-06S		2	1, 3	Male	269	3150	4	None
CC0376	31/Mar/2021	93-07E	CS9937	1	1	Female	250	2150	4	None
CC0377	5/Apr/2021	93-07W		2	1, 2	Male	283	3075		None
CC0378	5/Apr/2021	93-02E		2	1, 3	Unknown	104	200	4	None
CC0379	5/Apr/2021	93-02E		1	1	Unknown	130	405	4	None
CC0380	7/Apr/2021	93-02E	ILLEGIBLE	1	1	Female	265	3000		None observed but assessment limited
CC0381	7/Apr/2021	93-04E		1	1	Unknown	145	490		None observed but assessment limited
CC0382	8/Apr/2021	93-08E		1	1	Unknown	148	610		Assessment not possible
CC0383	8/Apr/2021	93-08E	CS9948	3	1, 2, 3	Female	255	2600		Assessment not possible
CC0384	8/Apr/2021	93-08E		1	1	Unknown	150	585		Assessment not possible
CC0385	8/Apr/2021	93-08E		2	1, 2	Unknown	130	415		Assessment not possible
CC0386	9/Apr/2021	93-08E	ILLEGIBLE	4	1, 2, 3	Male	261	2800		None observed but assessment limited
CC0387	9/Apr/2021	93-08E		3	1, 2, 3	Male	223	1800		Assessment not possible
CC0388	9/Apr/2021	93-08E		1	1	Male	235	2300		Assessment not possible
CC0389	22/Apr/2021	93-01W		1	3	Male	274	3900		Assessment not possible
CC0390	8/May/2021	95-10S		1	3	Female	245	2400		Assessment not possible
CC0391	31/Mar/2021	93-01W		1	1	Female	260	2800		None
CC0392	1/Apr/2021	93-01W		2	1	Female	254	2725	4	None
CC0393	1/Apr/2021	93-01W		1	1	Female	257	2400		None observed but assessment limited
CC0394	1/Apr/2021	93-01W		1	1	Unknown	148	650		None observed but assessment limited
CC0395	4/Apr/2021	93-06E		1	1	Female	266	2975		Assessment not possible
CC0396	4/Apr/2021	93-07W		1	1	Female	245	2275		Assessment not possible
CC0397	5/Apr/2021	93-07W	GS0323	1	1	Male	243	2400	5	None
CC0398	5/Apr/2021	93-07W		3	1, 2, 3	Female	259	2500		Assessment not possible
CC0399	8/Apr/2021	93-04E		3	1, 2, 3	Female	181	990		Assessment not possible
CC0404	8/Apr/2021	93-07E		2	2, 3	Unknown	131	450		Assessment not possible
CC0405	10/Apr/2021	93-08W		1	2	Unknown	76	60	4	None
CC0406	11/Apr/2021	93-08W		1	2	Unknown	76	60	4	None
CC0407	11/Apr/2021	93-08W		2	2, 3	Unknown	105	135		Assessment not possible

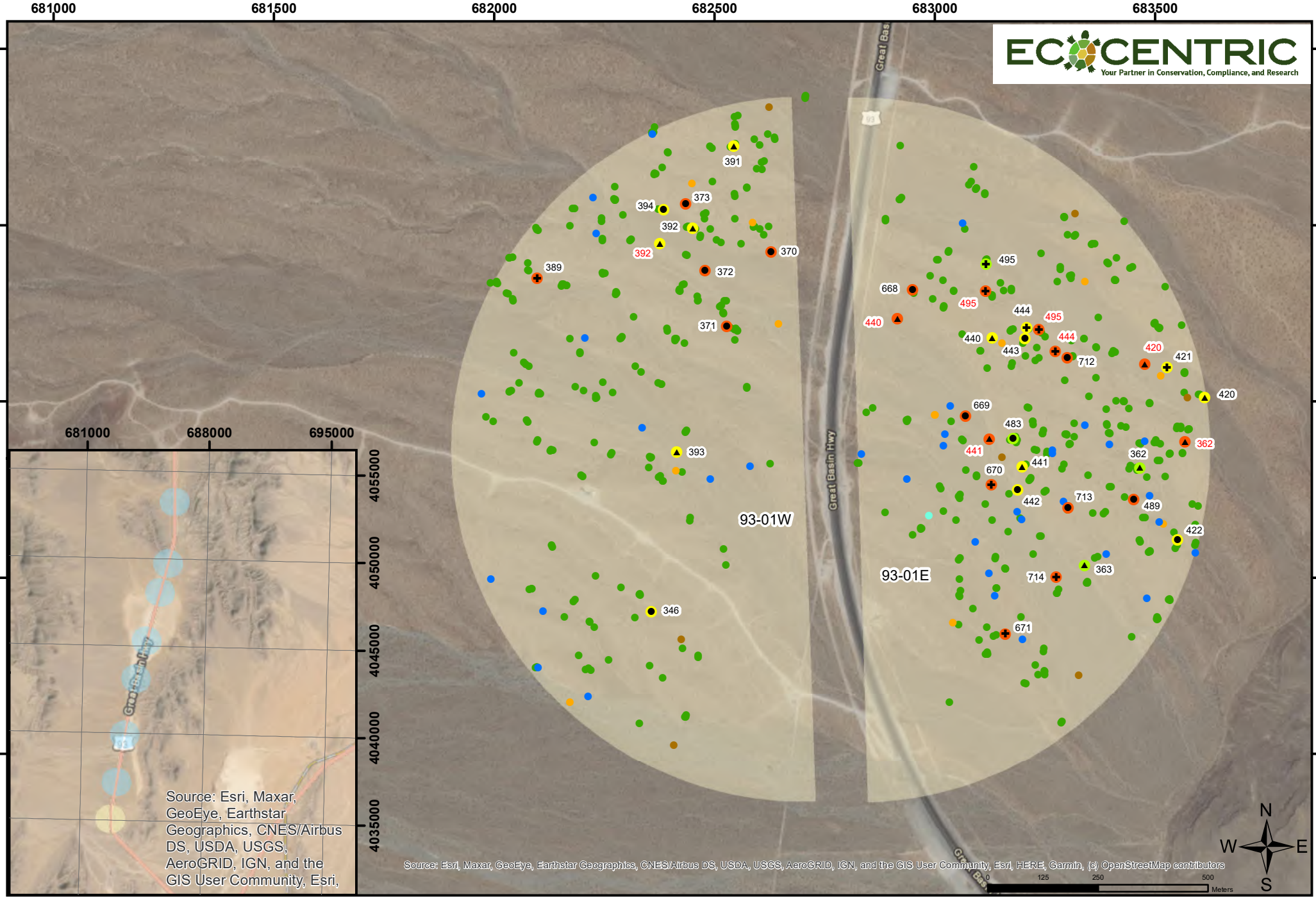
Tortoise ID	Initial Encounter Date	Plot ID	Alternate Tortoise ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0409	24/Mar/2021	93-02W		4	1, 2, 3	Male	308	4720	5	None
CC0410	24/Mar/2021	93-02W		1	1	Male	267	3150		None
CC0411	24/Mar/2021	93-02W		2	1, 3	Male	256	3250		Assessment not possible
CC0412	24/Mar/2021	93-02W		1	1	Male	277	3750		Assessment not possible
CC0413	25/Mar/2021	93-02W		3	1, 2, 3	Unknown	171	800	4	None
CC0414	25/Mar/2021	93-02W		4	1, 2, 3	Female	244	2200		Assessment not possible
CC0415	25/Mar/2021	93-02W		2	1, 3	Female	247	2325		Assessment not possible
CC0416	25/Mar/2021	93-02W		1	1	Female	249	2350		None observed but assessment limited
CC0417	26/Mar/2021	93-02W		3	1, 2, 3	Female	189	1050	3	None
CC0418	26/Mar/2021	93-02W		4	1, 2, 3	Unknown	173	850		Assessment not possible
CC0419	26/Mar/2021	93-02W		1	1	Male	249	2850		Assessment not possible
CC0420	27/Mar/2021	93-01E		2	1, 3	Female	260	2350		Assessment not possible
CC0421	27/Mar/2021	93-01E		1	1	Male	268	3000		Assessment not possible
CC0422	27/Mar/2021	93-01E		1	1	Unknown	83	75	3	None
CC0423	28/Mar/2021	93-08W		1	1	Unknown	120	250	3	None
CC0424	28/Mar/2021	93-08W		3	1, 2, 3	Male	239	1975		Assessment not possible
CC0425	28/Mar/2021	93-08W		1	1	Unknown	133	350		None
CC0426	29/Mar/2021	93-07E		2	1, 3	Unknown	139	500		Assessment not possible
CC0427	29/Mar/2021	93-07E		1	1	Unknown	132	400		None
CC0428	31/Mar/2021	95-10N		3	1, 2, 3	Female	230	2225		None observed but assessment limited
CC0429	3/Apr/2021	95-08S		3	1, 2, 3	Female	223	1950	3	None
CC0430	7/Apr/2021	95-07S		1	1	Male	237	1900	3	None
CC0431	10/Apr/2021	95-06N		1	1	Male	212	1400	3	None
CC0432	15/Apr/2021	93-02W		2	2, 3	Unknown	150	600		Assessment not possible
CC0433	16/Apr/2021	93-02W		1	2	Male	275	2675	3	None
CC0434	16/Apr/2021	93-02W		2	2, 3	Female	260	2850	3	None
CC0440	26/Mar/2021	93-01E		2	1, 3	Female	231	2530		None observed but assessment limited
CC0441	26/Mar/2021	93-01E		2	1, 3	Female	238	2248	4	None
CC0442	26/Mar/2021	93-01E		1	1	Unknown	85	85	3	None
CC0443	26/Mar/2021	93-01E		1	1	Unknown	142	540		Assessment not possible
CC0444	26/Mar/2021	93-01E		2	1, 3	Male	190	1294		Assessment not possible
CC0445	28/Mar/2021	93-08W		1	1	Unknown	117	271		Assessment not possible
CC0446	29/Mar/2021	93-08W		1	1	Male	266	2862		None observed but assessment limited

Tortoise ID	Initial Encounter Date	Plot ID	Alternate ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0447	29/Mar/2021	93-07E		2	1, 2	Female	235	2087	3	None
CC0448	29/Mar/2021	93-07E		2	1, 3	Unknown	119	269	4	None
CC0449	29/Mar/2021	93-07E		2	1, 2	Unknown	123	219	4	None
CC0450	29/Mar/2021	93-07E		1	1	Unknown	99	149	4	None
CC0451	29/Mar/2021	93-07E		2	1, 3	Unknown	104	173		Assessment not possible
CC0452	29/Mar/2021	93-07E		3	1, 2, 3	Male	236	2045		Assessment not possible
CC0453	31/Mar/2021	95-10N		1	1	Unknown	178	945		Assessment not possible
CC0454	3/Apr/2021	95-10S		2	1, 2	Male	237	2110		Assessment not possible
CC0455	3/Apr/2021	95-10S		1	1	Male	252	2700		Assessment not possible
CC0456	3/Apr/2021	95-10S		2	1, 3	Female	232	1950	3	None
CC0457	4/Apr/2021	95-10S		1	1	Male	240	2150		None observed but assessment limited
CC0458	5/Apr/2021	95-05N		2	1, 3	Unknown	153	540	3	None
CC0459	9/Apr/2021	95-05S		3	1, 3	Unknown	160	860	4	None
CC0460	9/Apr/2021	95-05S		1	1	Unknown	120	250	4	None
CC0461	9/Apr/2021	95-05S		2	1, 2	Female	222	1500		Assessment not possible
CC0462	10/Apr/2021	95-05S		1	1	Male	232	1700		None
CC0463	11/Apr/2021	95-09S		2	1, 3	Male	241	2600		None
CC0464	11/Apr/2021	95-09S		3	1, 3	Female	235	1950	3	None
CC0465	11/Apr/2021	95-09S		1	1	Male	202	1450	4	None
CC0466	12/Apr/2021	95-09S		3	1, 2, 3	Unknown	115	260	4	None
CC0467	12/Apr/2021	95-09S		3	1, 3	Male	187	990	4	None
CC0468	14/Apr/2021	93-02E		1	2	Unknown	133	320	3	None
CC0469	14/Apr/2021	93-02E		2	2, 3	Female	247	2400	4	None
CC0470	15/Apr/2021	93-08E		1	2	Unknown	109	220	3	None
CC0471	15/Apr/2021	93-08E		2	2, 3	Unknown	83	70	3	None
CC0473	16/Apr/2021	93-02E		1	2	Unknown	60	36	4	None
CC0474	16/Apr/2021	93-02E		2	2, 3	Male	219	1500		Assessment not possible
CC0475	16/Apr/2021	93-08E		2	2, 3	Female	250	2500		Assessment not possible
CC0476	17/Apr/2021	93-08E		1	2	Male	210	1300		Assessment not possible
CC0477	5/Apr/2021	95-07N		2	1	Male	222	1830	4	None
CC0478	5/Apr/2021	95-07S		3	1, 2, 3	Unknown	143	458	4	None
CC0479	6/Apr/2021	95-07S		2	1, 2	Unknown	132	335	4	None
CC0480	6/Apr/2021	95-07S		4	1, 2, 3	Female	264	2073	3	None
CC0481	15/Apr/2021	95-09S		1	2	Unknown	135	358	4	None
CC0482	17/Apr/2021	95-10S		1	2	Male	257	2775	4	None
CC0483	22/Apr/2021	93-01E		1	2	Unknown	138	470		Assessment not possible
CC0484	24/Apr/2021	93-07E	CS9933	1	3	Male	223	1850	4	None
CC0485	25/Apr/2021	93-07E		1	3	Female	252	2260		None
CC0486	26/Apr/2021	93-08E		1	3	Unknown	88	105	4	None
CC0487	26/Apr/2021	93-08E		1	3	Unknown	99	160	4	None
CC0488	26/Apr/2021	93-08E		1	3	Female	242	2200	4	None
CC0489	29/Apr/2021	93-01E		1	3	Unknown	91	150	4	None

Tortoise ID	Initial Encounter Date	Plot ID	Alternate ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0490	17/Apr/2021	95-08S		1	2	Unknown	143	480	4	None
CC0491	17/Apr/2021	95-08S		1	2	Unknown	151	700		None observed but assessment limited
CC0492	18/Apr/2021	95-08S		2	2, 3	Female	216	2050		None observed but assessment limited
CC0493	18/Apr/2021	95-08S		1	2	Female	230	1975	4	None
CC0494	18/Apr/2021	95-08S		1	2	Unknown	122	320		None observed but assessment limited
CC0495	22/Apr/2021	93-01E		3	2, 3	Male	223	1900		Assessment not possible
CC0512	30/Apr/2021	93-08W		1	3	Female	223	1900		None
CC0513	30/Apr/2021	93-08W		1	3	Unknown	155	650		Left Naris serous discharge, Right naris Serous discharge
CC0514	1/May/2021	93-04E		1	3	Unknown	139	420	4	None
CC0515	1/May/2021	93-04E		1	3	Female	236	1450	3	None
CC0516	15/May/2021	95-05S		1	3	Unknown	149	550	3	None
CC0562	28/Apr/2021	93-07W		1	3	Male	284	3450		None observed but assessment limited
CC0563	7/May/2021	95-06S		1	3	Unknown	172	830	4	None
CC0564	7/May/2021	95-06S		1	3	Unknown	138	425	4	None
CC0565	10/May/2021	95-09S		1	3	Unknown	50			None
CC0662	23/Apr/2021	93-05W		1	2	Unknown	141	440		Assessment not possible
CC0663	25/Apr/2021	93-08E		1	3	Unknown	102	150	3	None
CC0664	26/Apr/2021	93-08E		1	3	Unknown	175	900		Assessment not possible
CC0665	26/Apr/2021	93-08E		1	3	Male	225	1750		None observed but assessment limited
CC0666	26/Apr/2021	93-08E		1	3	Unknown	102	110		None
CC0667	26/Apr/2021	93-08E		1	3	Unknown	130	280	3	None
CC0668	29/Apr/2021	93-01E		1	3	Unknown	134	390	2	None
CC0669	29/Apr/2021	93-01E		1	3	Unknown	152	545		Assessment not possible
CC0670	29/Apr/2021	93-01E		1	3	Male	268	3300	4	None
CC0671	29/Apr/2021	93-01E		1	3	Male	201	1250	4	None
CC0672	2/May/2021	95-04S		2	2, 3	Unknown	135	430	3	None
CC0673	3/May/2021	95-04S		2	2, 3	Unknown	130	375	4	None
CC0674	9/May/2021	95-01S		1	3	Unknown	140	355		Assessment not possible
CC0675	10/May/2021	95-01S		1	3	Female	238	2400	4	None
CC0676	10/May/2021	95-01S		1	3	Unknown	121	300	4	None
CC0677	13/May/2021	95-04S		1	3	Male	205	1700	4	None
CC0712	29/Apr/2021	93-01E		1	3	Unknown	146	520	4	None

Tortoise ID	Initial Encounter Date	Plot ID	Alternate ID	Total Encounters	Survey Rounds Detected	Sex	MCL (mm)	Mass (g)	BCS	Clinical Signs of Disease
CC0713	29/Apr/2021	93-01E		1	3	Unknown	129	385	4	None
CC0714	29/Apr/2021	93-01E		1	3	Male	300	6000	3	None
CC0715	30/Apr/2021	93-08W		1	3	Unknown	159	740	4	None
CC0716	1/May/2021	93-04E		1	3	Female	260	3000	4	None
CC0717	1/May/2021	93-04E		1	3	Female	308	10000	4	None
CC0718	2/May/2021	93-02W		1	3	Female	255	3300	4	None
CC0719	6/May/2021	95-07S		1	3	Male	197	1400	4	None
CC0720	7/May/2021	95-08S		1	3	Unknown	70	55		Assessment not possible
CC0721	8/May/2021	95-08S		1	3	Male	244	2250	4	None
CC0722	9/May/2021	95-08S		1	3	Unknown	138	475		Assessment not possible
CC0723	9/May/2021	95-08S		1	3	Unknown	95	180	4	None
CC0724	10/May/2021	95-03S		1	3	Female	238	1750		Assessment not possible
CC0725	14/May/2021	95-05S		1	3	Unknown	134	300	1	None
UNKNOWN-93.1	25/Apr/2021	93-07E		1	3	Unknown				Assessment not possible
UNKNOWN-95.1	17/Apr/2021	95-10S		1	2	Female				Assessment not possible

Appendix B – US-93 Tortoise Encounter and Sign Locations



Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

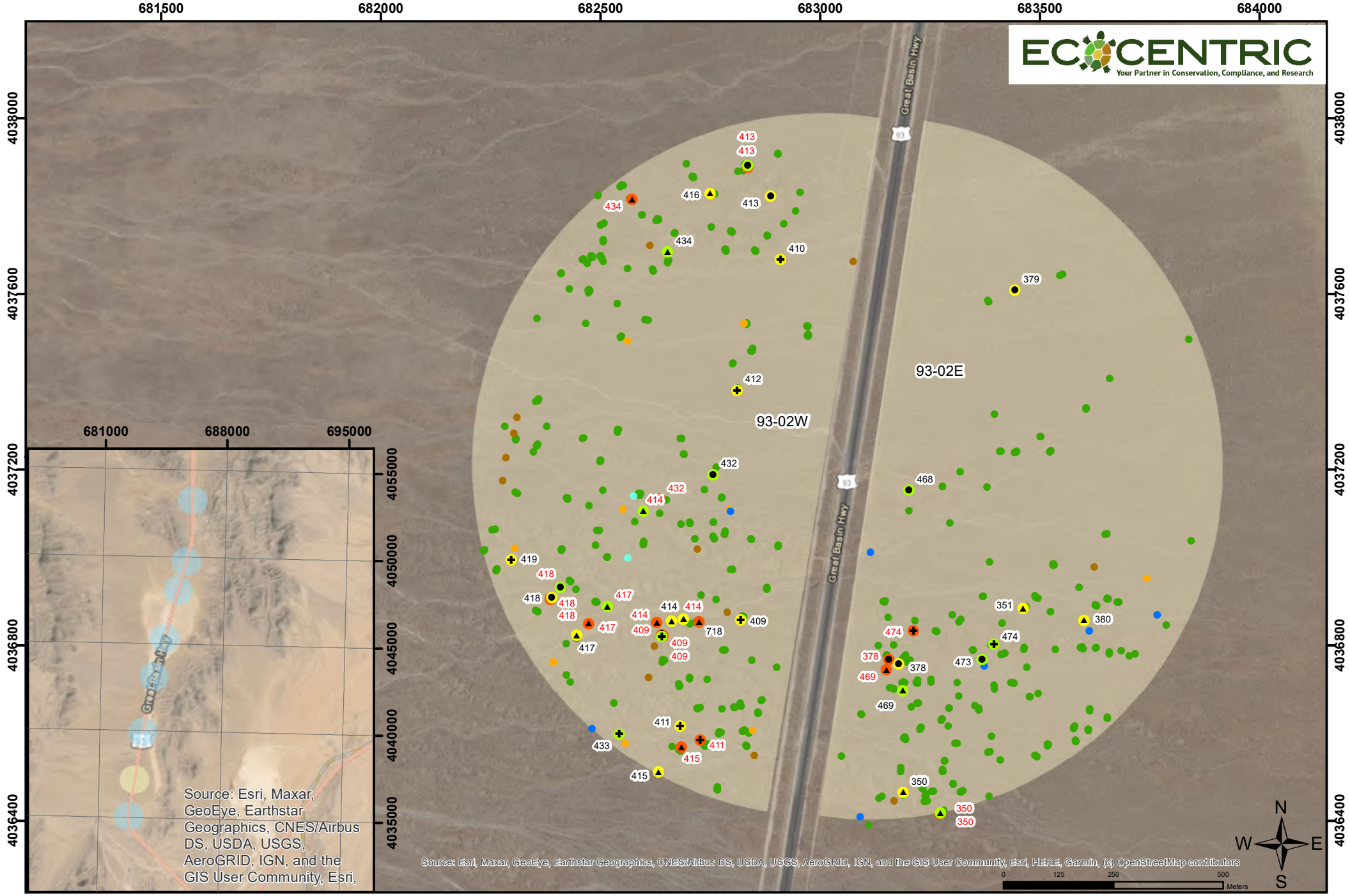
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 7. 93-01E and 93-01W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

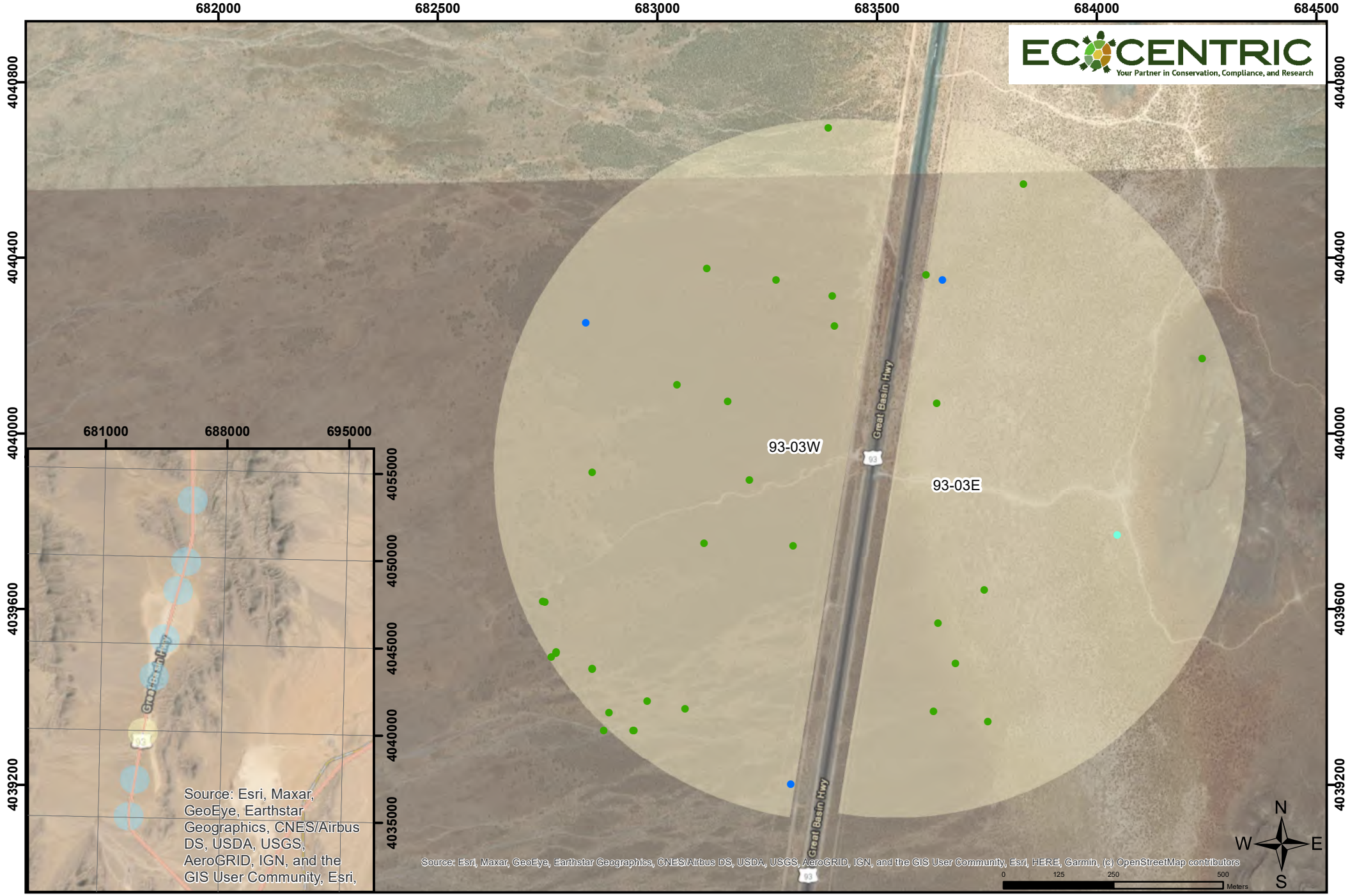
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 8. 93-02E and 93-02W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



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Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

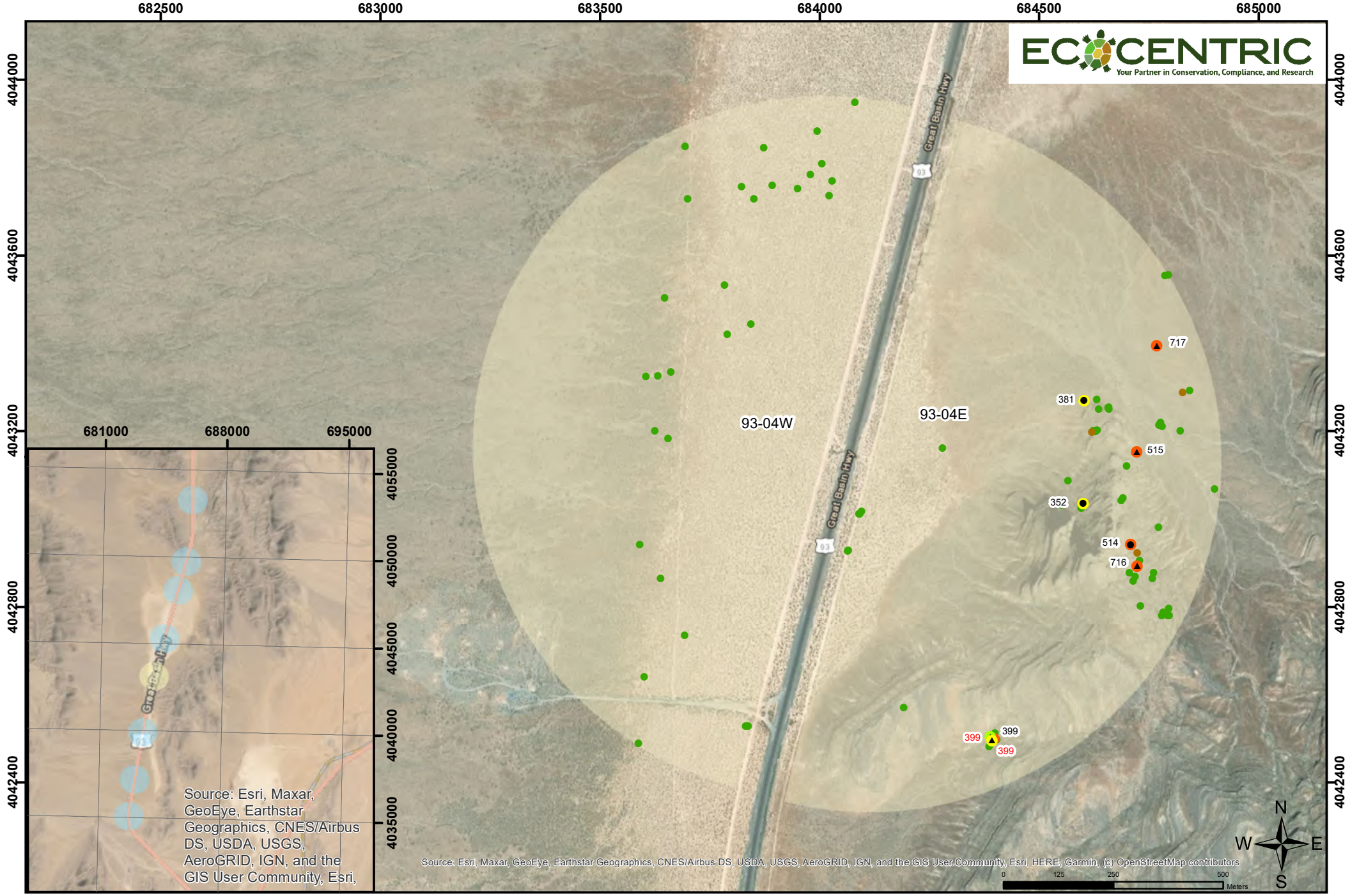
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 9. 93-03E and 93-03W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)
- 1
- 2
- 3

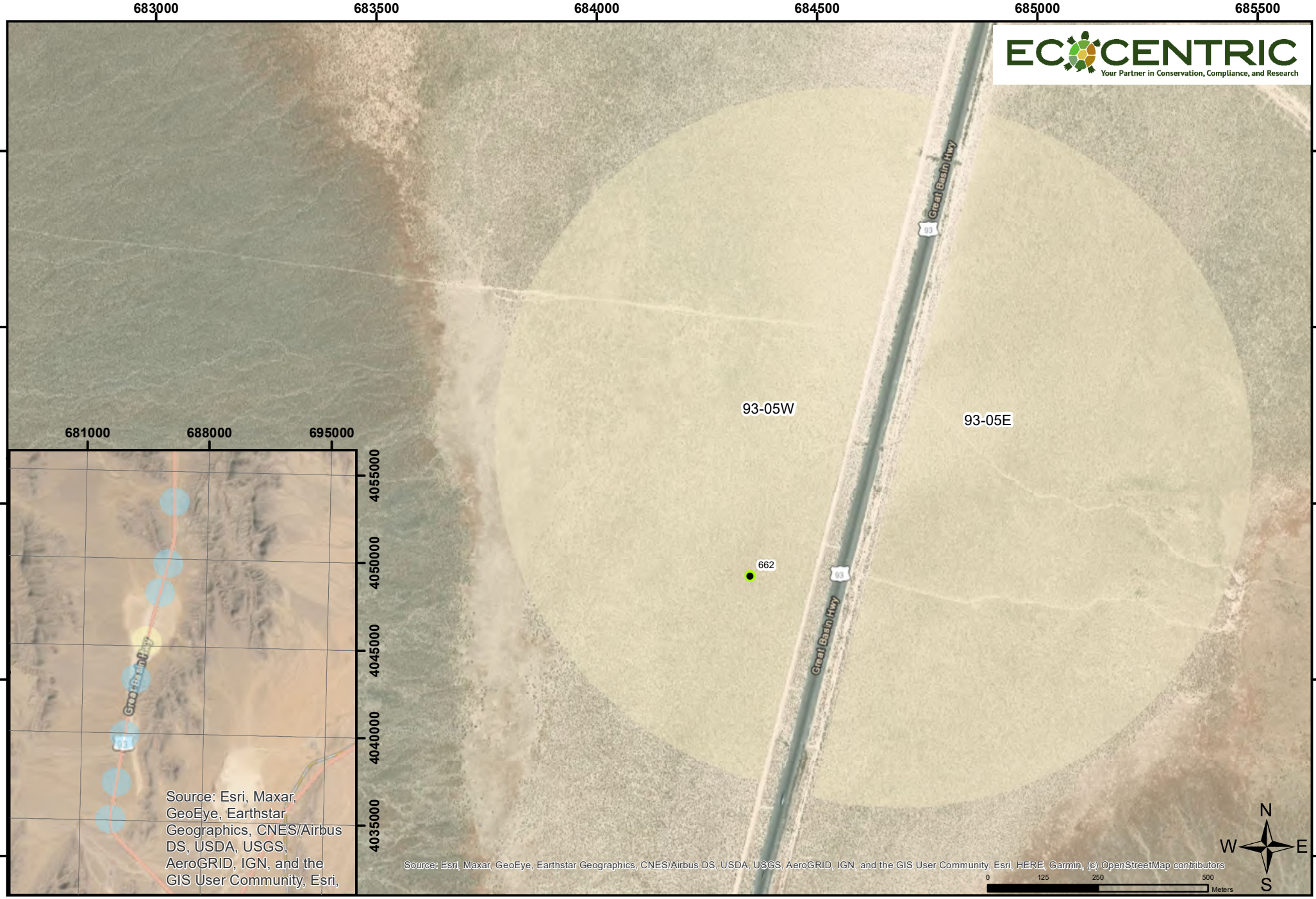
Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots
Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 10. 93-04E and 93-04W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



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Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

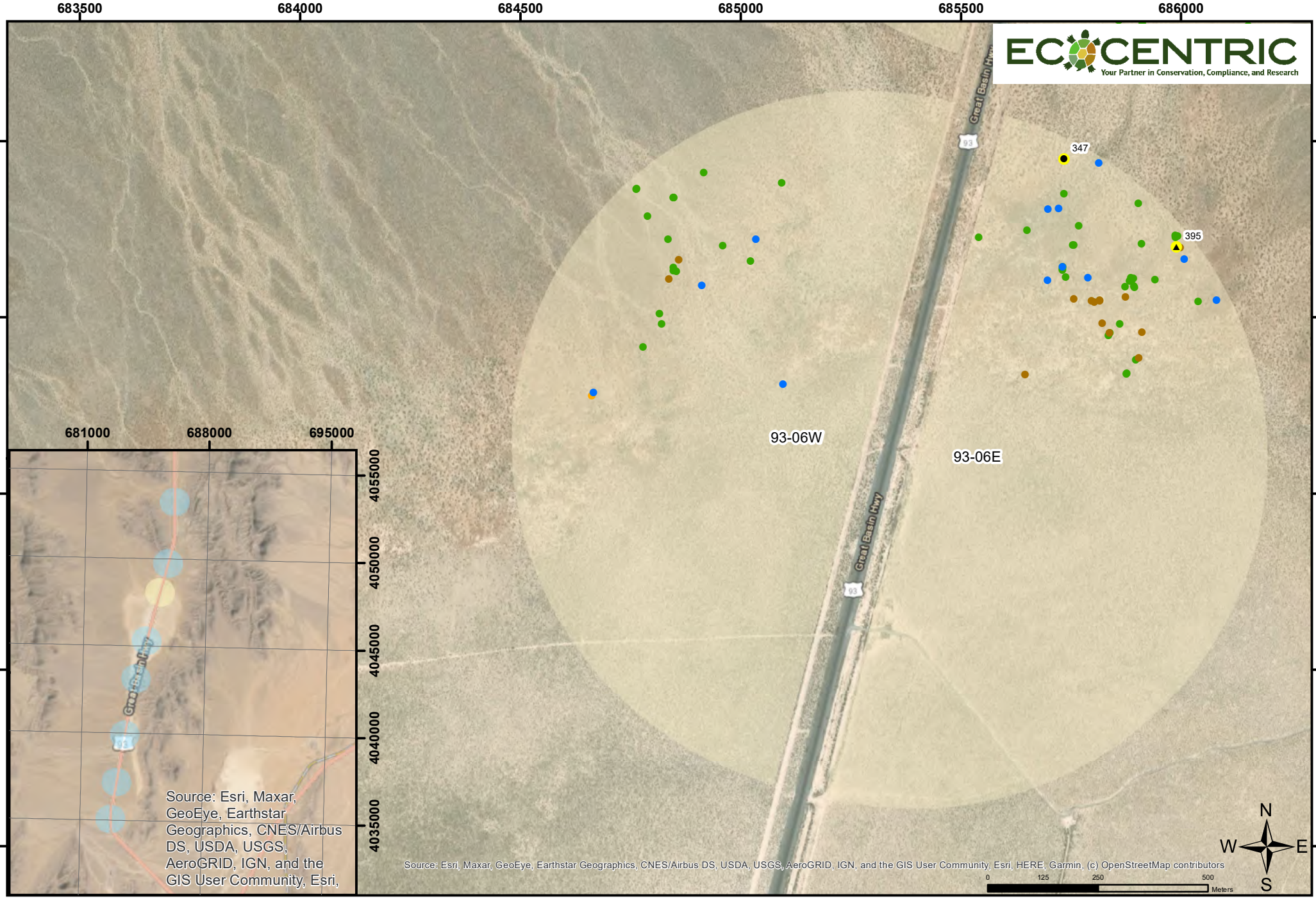
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 11. 93-05E and 93-05W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



ECOCENTRIC
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Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

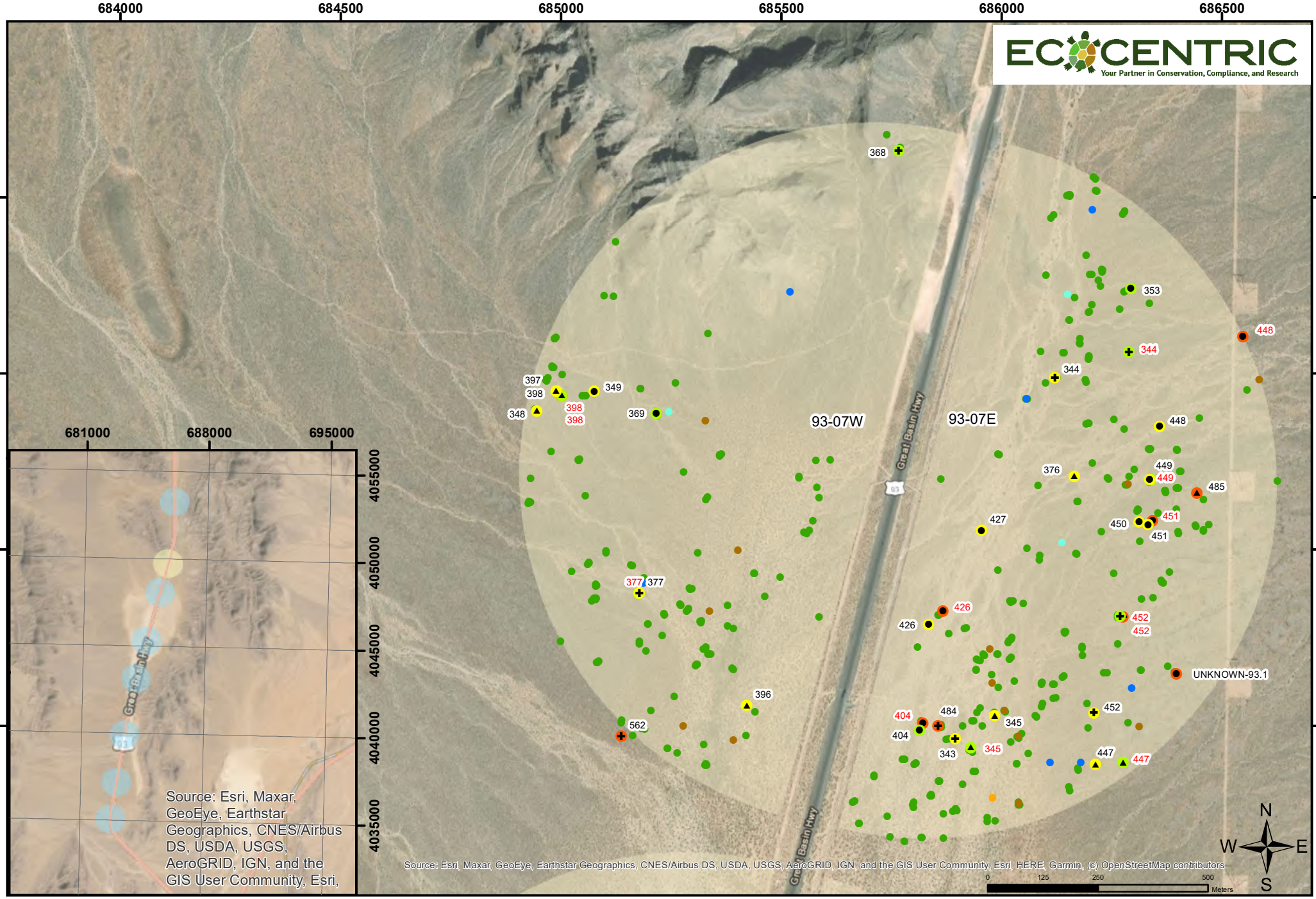
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 12. 93-06E and 93-06W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)
- 1
- 2
- 3

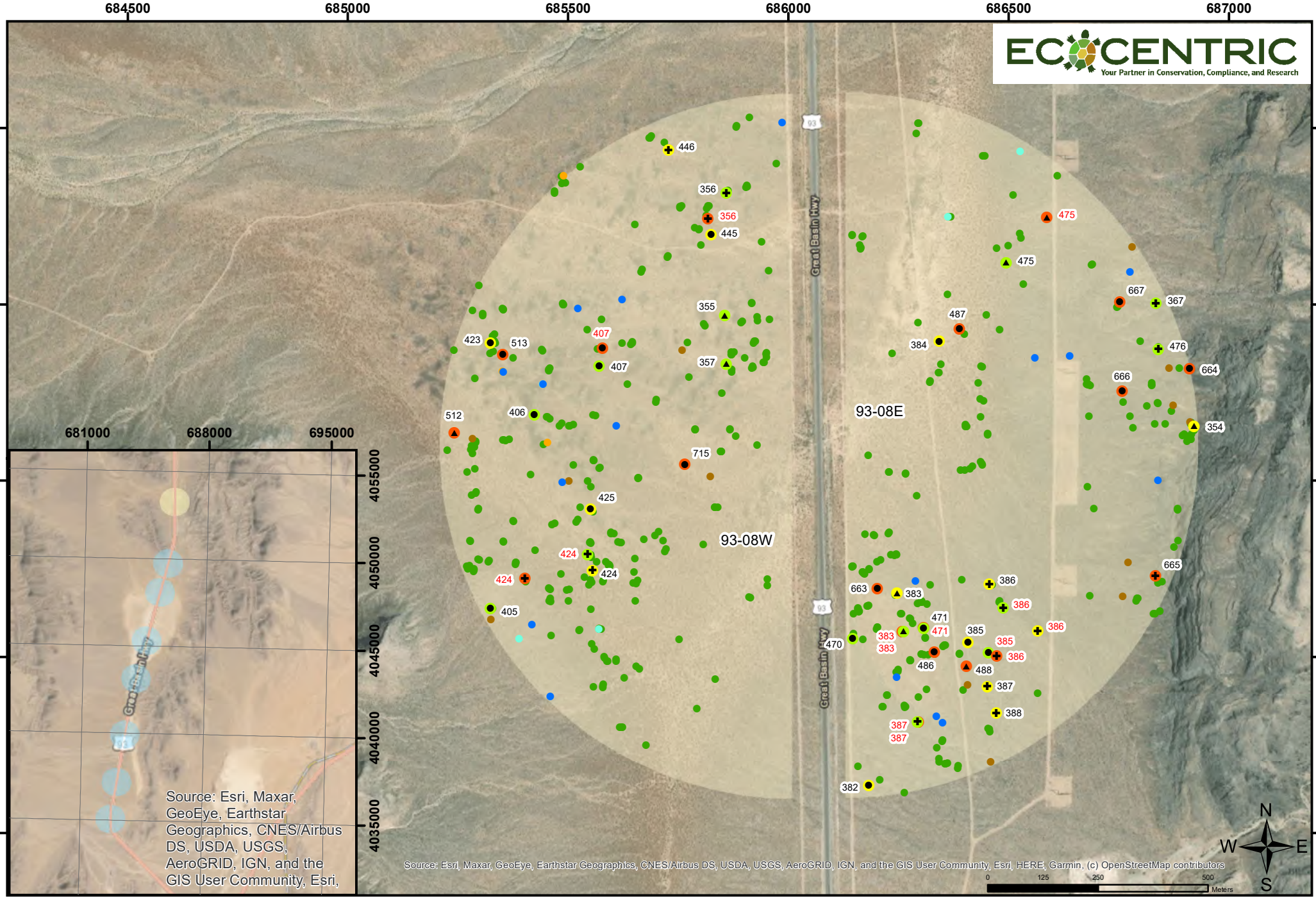
Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots
Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 13. 93-07E and 93-07W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots

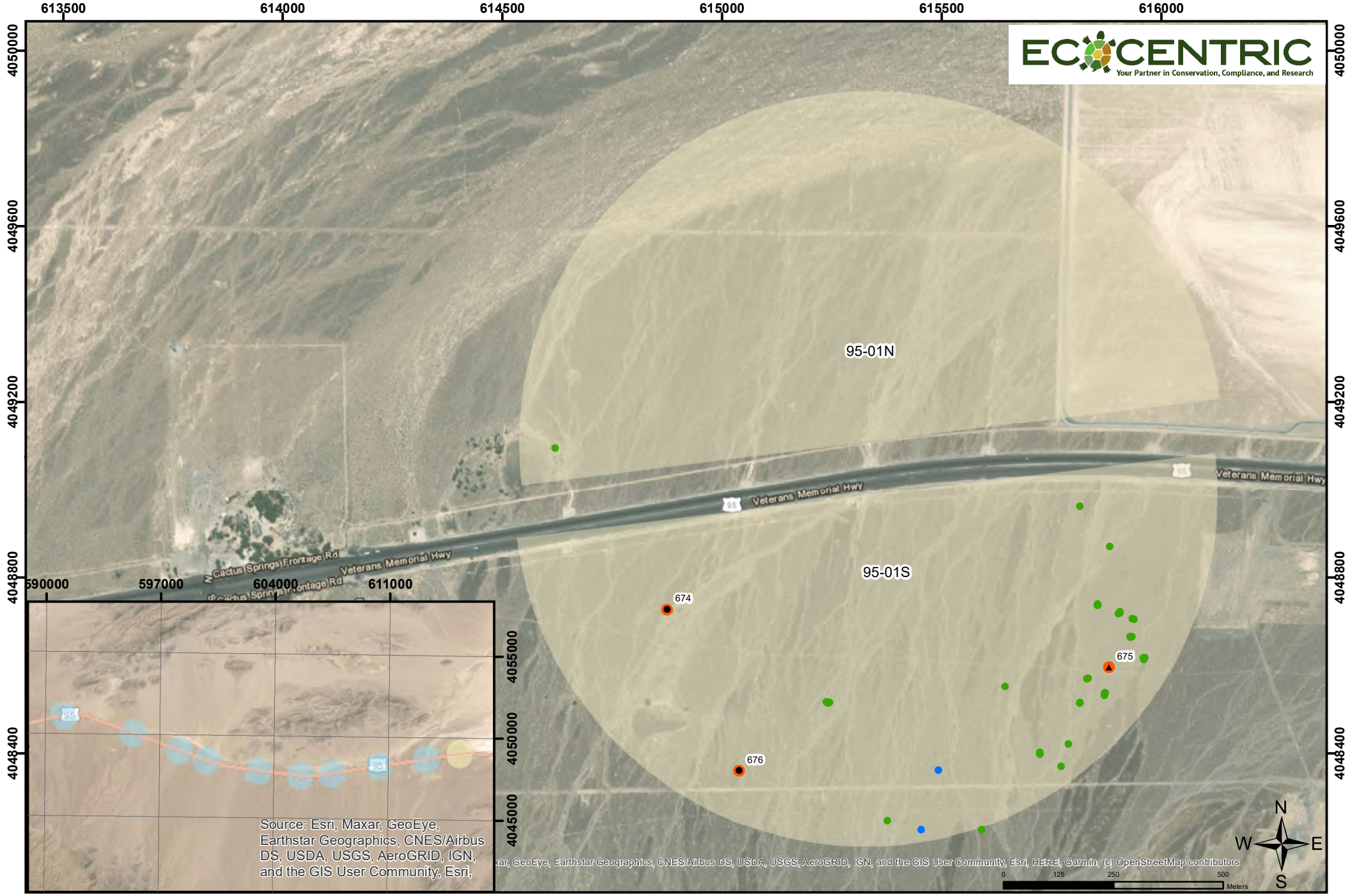
Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 14. 93-08E and 93-08W Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.

Appendix C – US-95 Tortoise Encounter and Sign Locations



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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round
- 1
- 2
- 3

Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

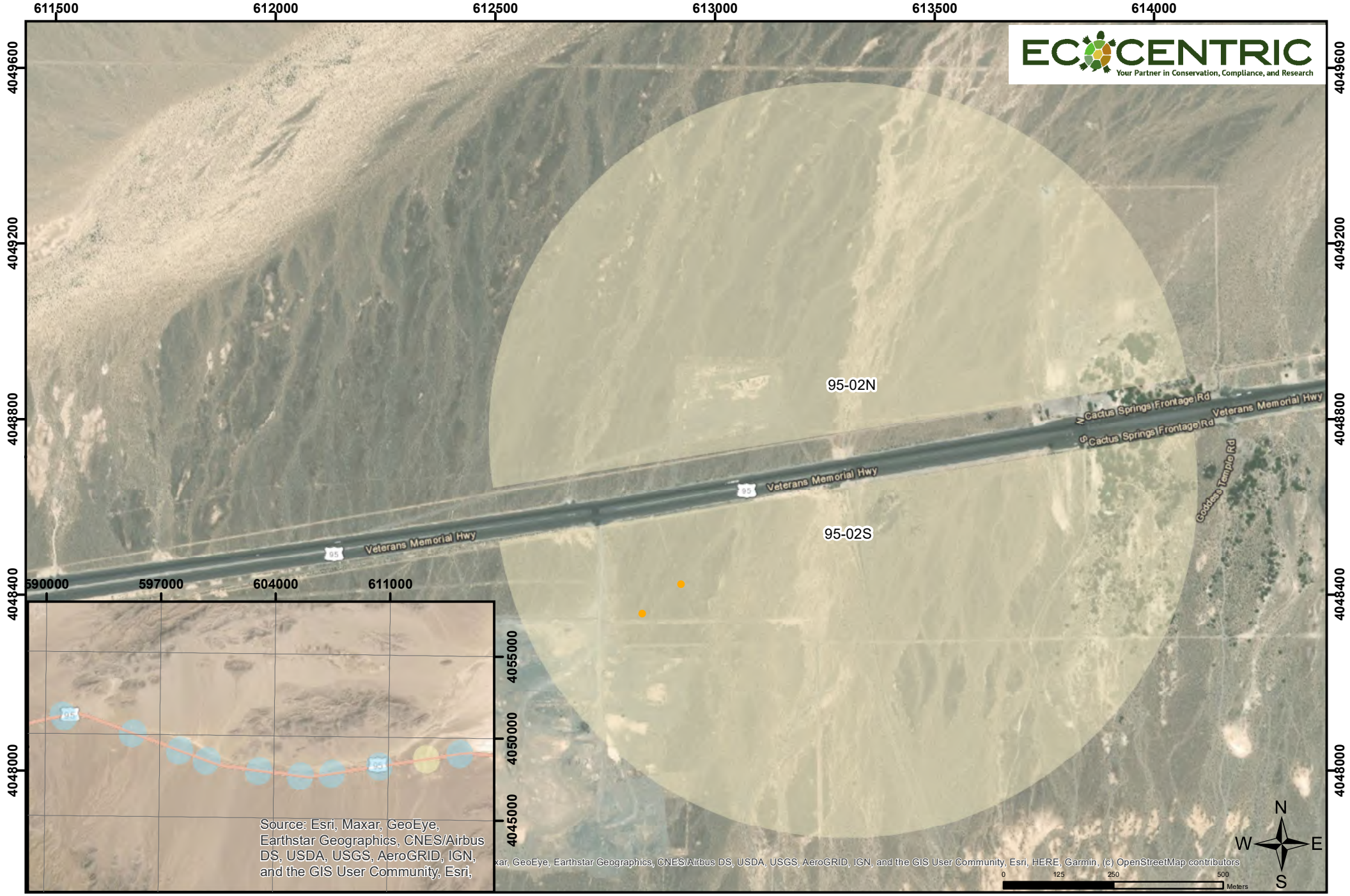
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 15. 95-01N and 95-01S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



ECOCENTRIC
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Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round

- 1
- 2
- 3

Sign Type

- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

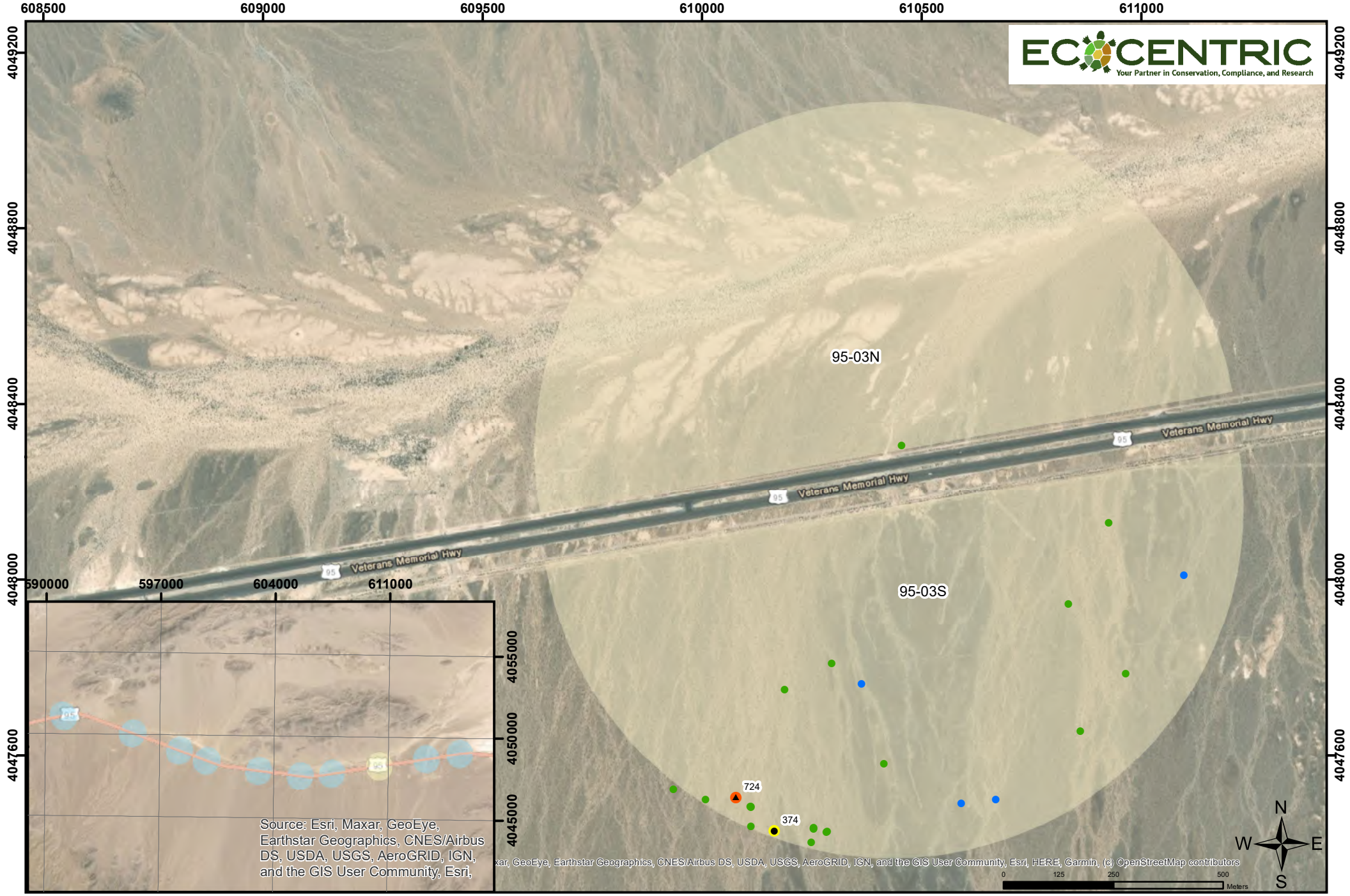
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 16. 95-02N and 95-02S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



ECOCENTRIC
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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round
- 1
- 2
- 3

Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

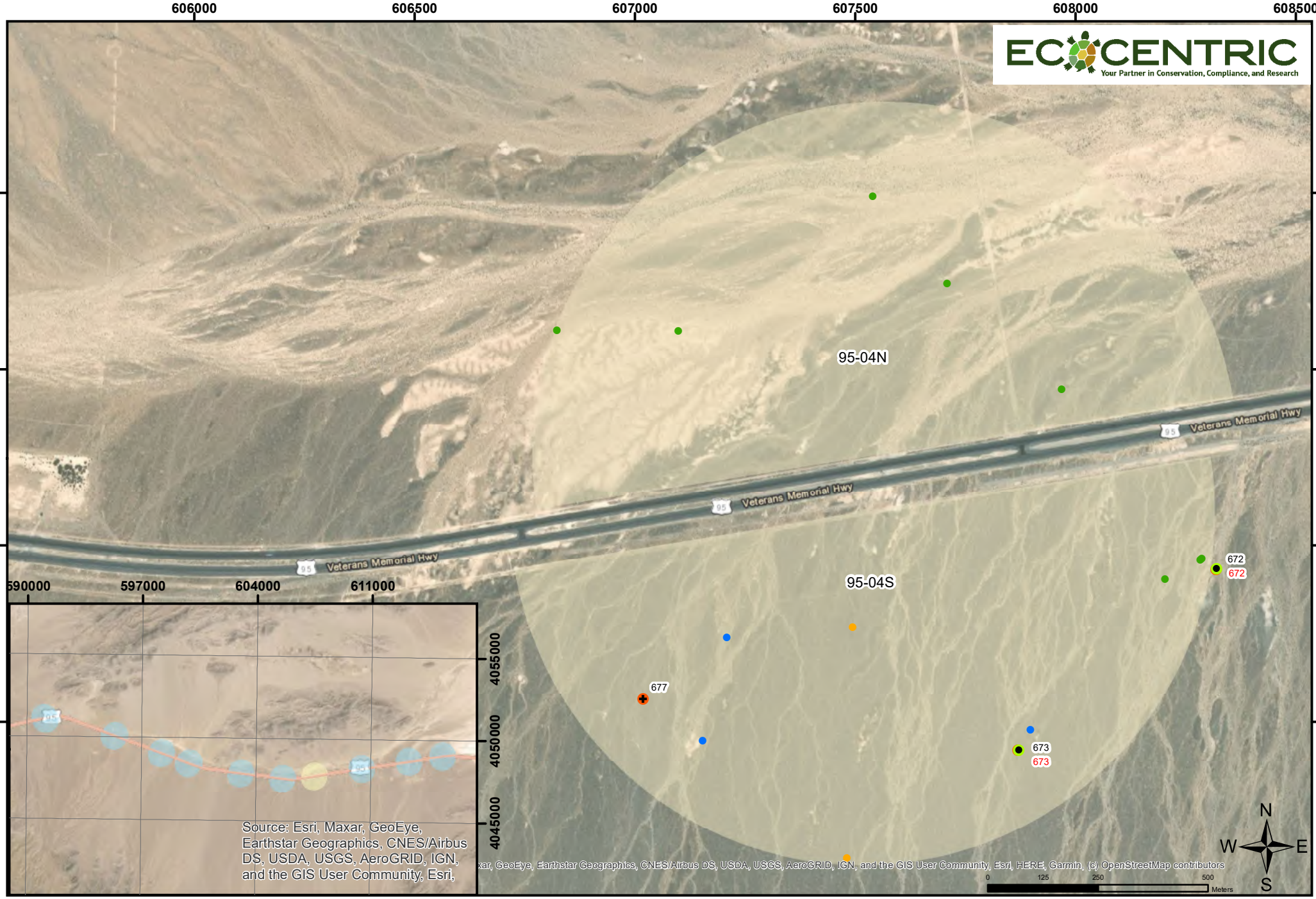
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 17. 95-03N and 95-03S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)
- 1
- 2
- 3

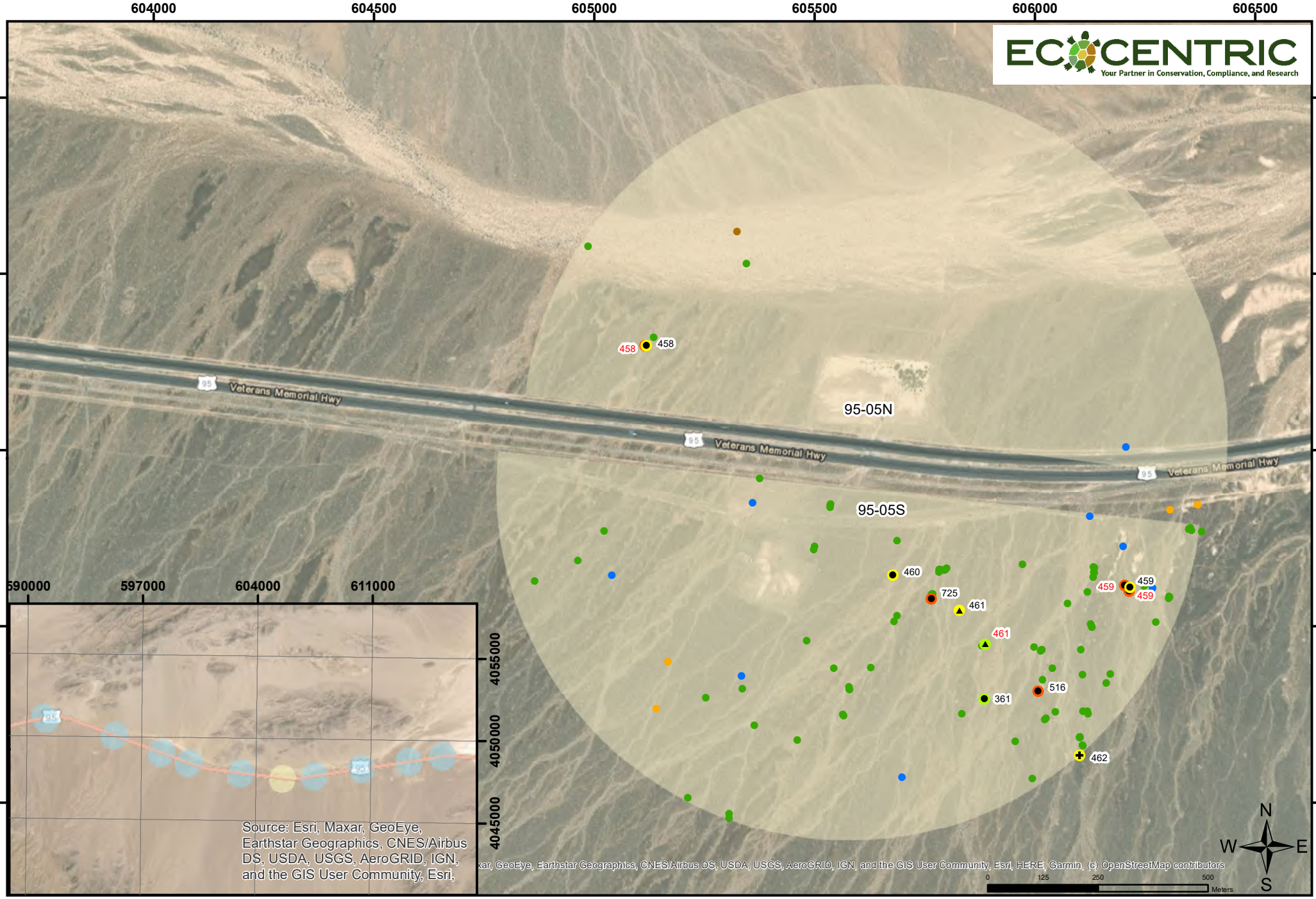
Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots
Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 18. 95-04N and 95-04S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



ECOCENTRIC
Your Partner in Conservation, Compliance, and Research

Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round (Halo)
- 1
- 2
- 3

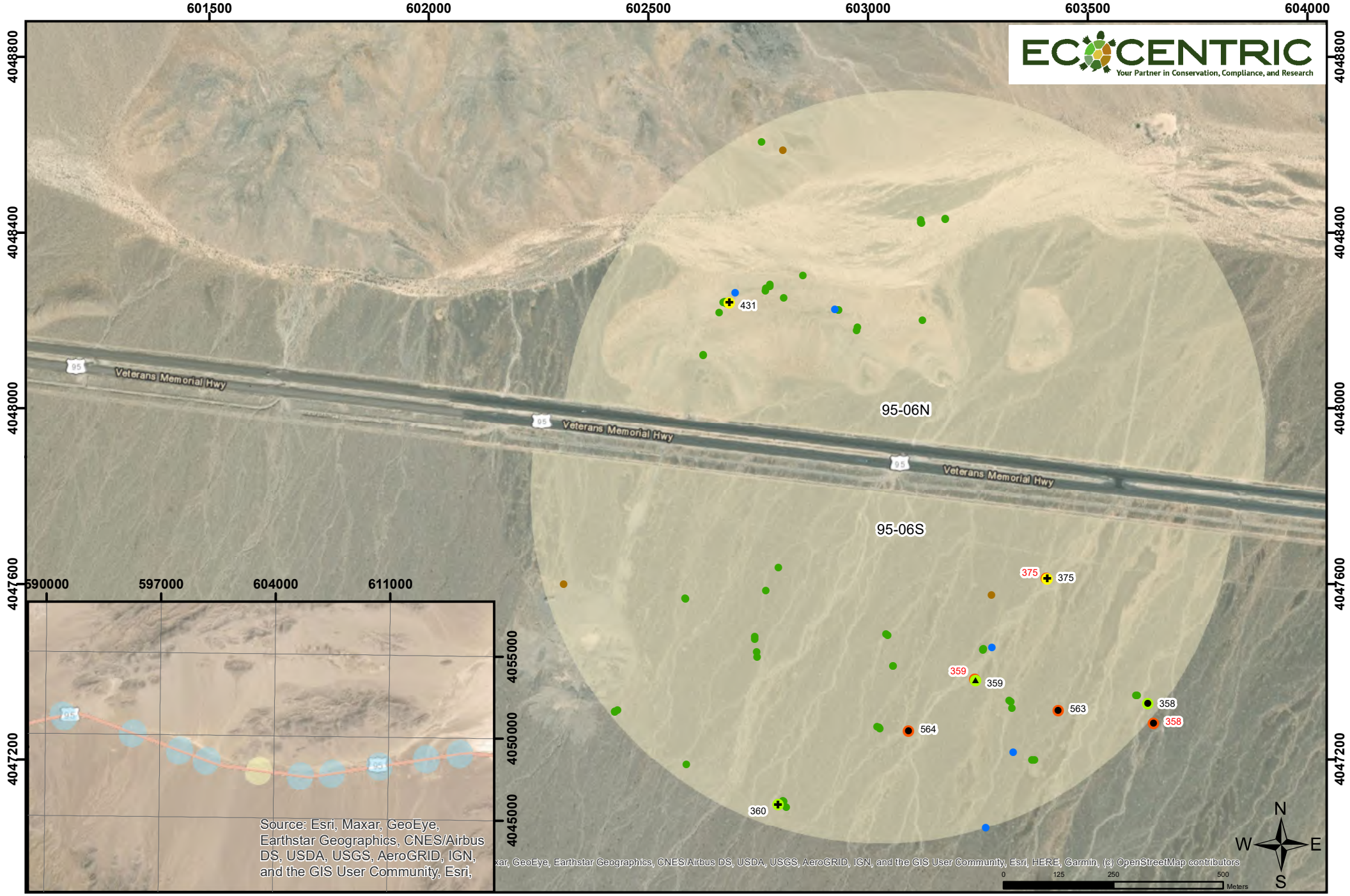
Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots
Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 19. 95-05N and 95-05S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



Tortoise Sex

- ▲ *Female*
- ✚ *Male*
- ● *Unknown*

Survey Round (Halo)

- *1*
- *2*
- *3*

Sign Type

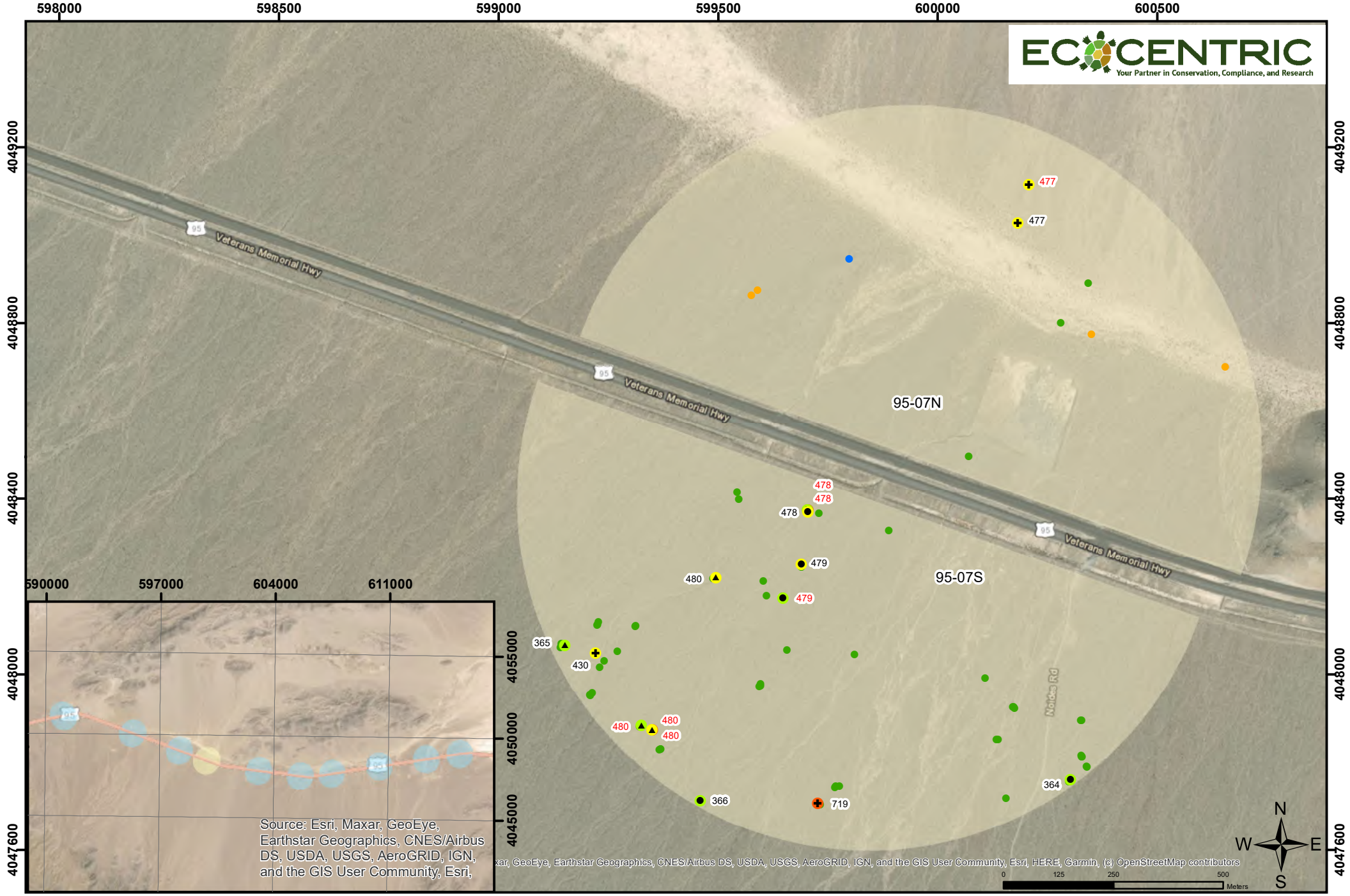
- *Burrow*
- *Carcass*
- *Egg Shell*
- *Fragments (Scute/Bone)*
- *Scat*

- *US95 Survey Plots*
- *Survey Plot*

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 20. 95-06N and 95-06S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is intended for display purposes only.



ECOCENTRIC
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Tortoise Sex

- ▲ Female
- ✚ Male
- ● Unknown

Survey Round

- 1
- 2
- 3

Sign Type

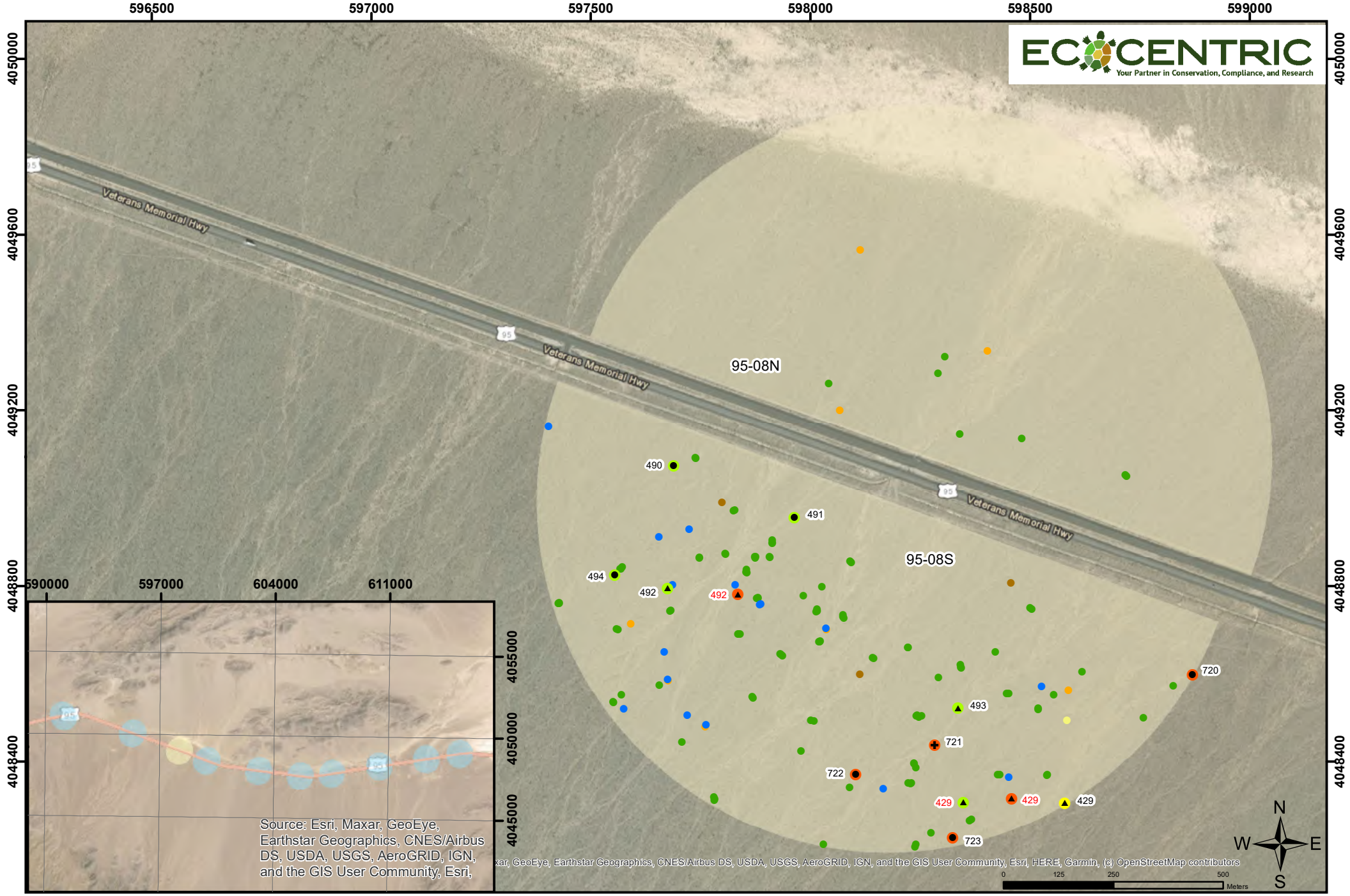
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

- US95 Survey Plots
- Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 21. 95-07N and 95-07S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



Tortoise Sex

- ▲ *Female*
- ✚ *Male*
- ● *Unknown*

Survey Round

- *1*
- *2*
- *3*

Sign Type

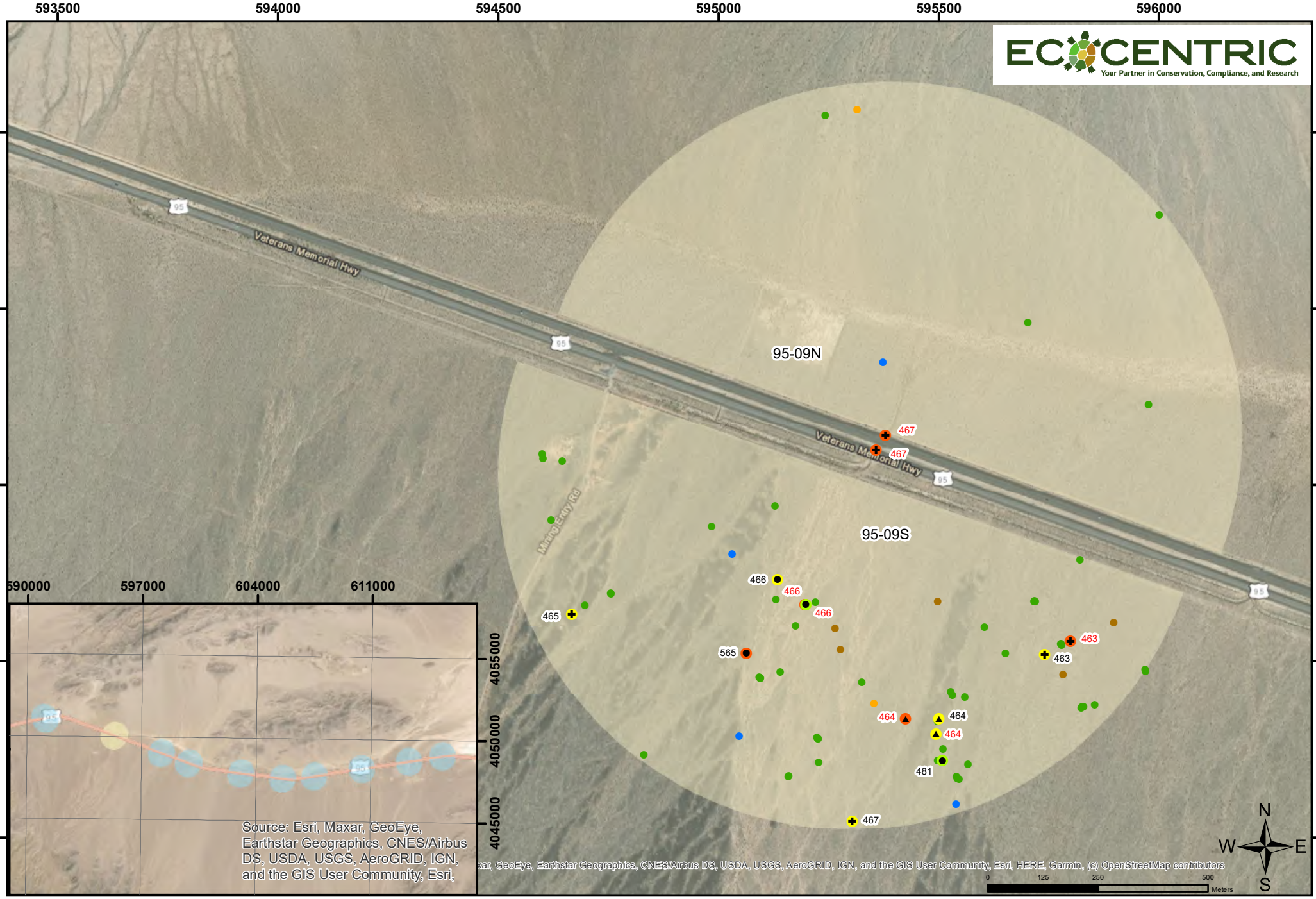
- *Burrow*
- *Carcass*
- *Egg Shell*
- *Fragments (Scute/Bone)*
- *Scat*

- *US95 Survey Plots*
- *Survey Plot*

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 22. 95-08N and 95-08S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



ECOCENTRIC
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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round
- 1
- 2
- 3

Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

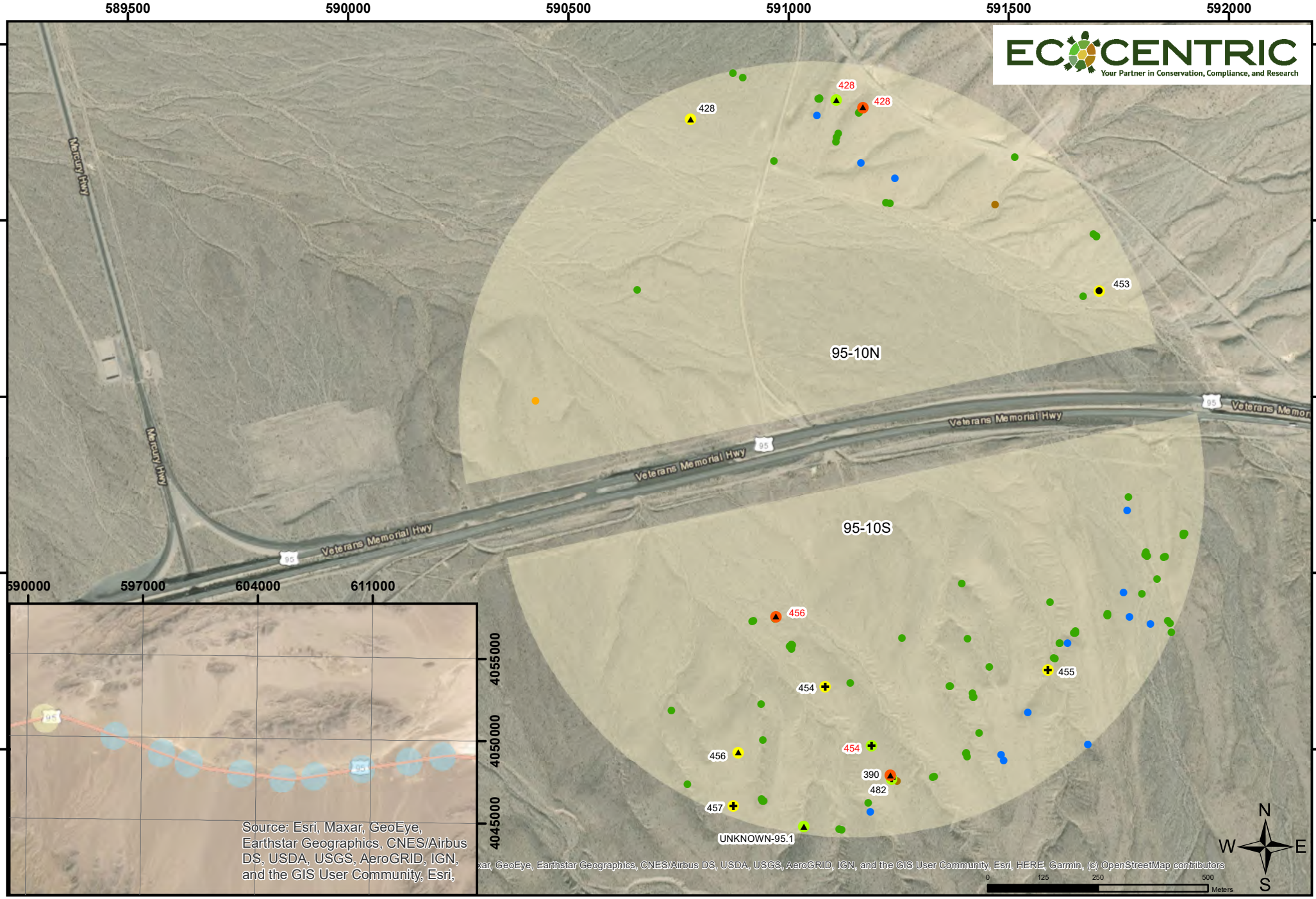
US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 23. 95-09N and 95-09S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.



ECOCENTRIC
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Tortoise Sex
- ▲ Female
- ✚ Male
- ● Unknown

Survey Round
- 1
- 2
- 3

Sign Type
- Burrow
- Carcass
- Egg Shell
- Fragments (Scute/Bone)
- Scat

US95 Survey Plots

Survey Plot

Tortoise Number Label:
Black = Initial Encounter
Red = Recapture

Figure 24. 95-10N and 95-10S Tortoise Encounter and Sign Locations
Desert Tortoise Connectivity Across Roadways
2015-ECOCENT-1580B
Clark County, Nevada

This map is for display purposes only.