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IVANPAH SOLAR ELECTRIC GENERATING SYSTEM
AVIAN & BAT MONITORING PLAN

2014 SUMMER REPORT
(23 MAY – 17 AUGUST 2014)

Project # 2802-07

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Executive Summary

Avian and bat monitoring surveys were conducted from 23 May to 17 August 2014 (the summer season) at the Ivanpah Solar Electric Generating System facility (referred to in this report as "Ivanpah" or "Project") in accordance with the Project's Avian & Bat Monitoring and Management Plan (Plan). Specifically, avian point count surveys, raptor/large bird surveys, facility monitoring for avian detections, searcher efficiency trials, and carcass removal trials were conducted. This report represents the third "quarterly" (i.e., seasonal) report summarizing monitoring methods and results for those surveys based on the procedures and requirements specified in the Plan.

Avian and bat monitoring surveys included avian point counts, raptor and large bird point counts, and fatality searches. Avian point count surveys were conducted using variable-radius point counts at 80 survey points, including 40 points in heliostat arrays and 40 points in desert bajada habitats. A total of 19 bird species were recorded during these surveys. Species richness was highest on the upper desert bajada grid (12 species), slightly lower on the lower desert bajada grid (11 species), and lowest in the heliostat grids (seven species in Unit 1, four in Unit 2, and one in Unit 3). Avian abundance was similar on the two desert bajada grids, with 140 observations on the upper bajada and 142 on the lower bajada. Abundance was substantially lower in the three heliostat grids, with 28 observations in Unit 1, 15 observations in Unit 2, and one observation in Unit 3.

Surveys for raptors and other large birds were conducted at each of eight points (one on the east and west sides of each of the power units and two offsite points). Three surveys were conducted at each point. During these surveys, three raptor species and three other large bird species (common raven, California gull, and ring-billed gull) were identified. Common ravens comprised 40.5% of all large bird detections. Overall abundance of raptors and other large birds was higher on the eastern points than on the western points.

Avian and bat fatality searches were conducted in 1) the "tower area", consisting of the power block and inner high-density (HD) heliostats surrounding each power block on approximately 154 acres, which was surveyed with 100% coverage; 2) the "heliostat area", consisting of the inner and outer heliostat segments outside of the inner HD heliostats on approximately 720 acres, which was surveyed with 24.1% coverage in randomly selected arc-shaped plots; 3) the "fence line", consisting of the perimeter fences, which was 100% surveyed; 4) the "collector line", consisting of the Unit 3 Collector Line, which was also 100% surveyed; and 5) offsite "control areas." Overall, approximately 29.2% of the facility was searched (not including the offsite control areas, which are outside the facility). Searches were conducted within the summer season at intervals averaging 21.0 days (range 18 to 23 days, median = 21 days).

All bird and bat fatalities and injuries, including those found incidentally, are referred to as "detections" hereafter. According to the specifications of the Plan, avian detections were input into a fatality estimator equation (model) to provide an estimate of the fatalities for the facility. All fatalities were classified as either carcasses or feather spots. Feather spots consisted of groups of feathers composed of at least two or more

primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller; feathers with significant skin or flesh, or any bone, attached were considered detections but were not necessarily considered feather spots.

During the period 23 May – 17 August 2014, a total 115 avian fatalities (including three injured birds that died shortly after detection), one apparently sick bat, and 11 bat fatalities were detected. Thirty-six avian species and four bat species were positively identified among these detections. A total of 88 avian detections and 10 bat detections occurred during systematic fatality searches. Twenty-seven avian detections and two bat detections were made incidentally by workers performing operational duties, in accordance with the reporting protocol of the Ivanpah Wildlife Incident Reporting System.

A total of 66 bird detections (57.4%) were recorded within the tower area (the area consisting of the power block and inner HD heliostats). This area, circumscribed by a 260-m radius from the tower and comprising approximately 5% of the facility, was searched with 100% coverage due to proximity to the towers. In addition, these towers were the focus of considerable activity by Ivanpah personnel, who detected and reported fatalities, resulting in high numbers of incidental fatality reports. As discussed below, all 42 avian detections showing evidence of singeing (100%), as determined by microscopic examination, were located within the tower area. Of the 66 bird detections in the tower area, 24 were in ACC units; 22 of these showed evidence of singeing or collision, and two were considered to have died from "other project impacts".

In the other survey areas, 40 avian detections (34.8%) were recorded for the much larger area composed of the inner and outer heliostats. Six detections were discovered along the fence line (5.2%), three were on Project lands outside the standardized search areas (2.6%), and none were found along the off-site control transects or under the Unit 3 collector line. All bat fatalities were observed in the power block, with 10 of the 11 located in the air cooled condenser (ACC) building and one adjacent to the ACC in Unit 2.

Of the 115 avian fatalities detected during 2014 summer season, 42 fatalities (36.5%) showed signs of singed feather damage. Visible evidence of collision (primarily with heliostats) was found in the case of 10 detections (8.7%). Two additional detections with no signs of singeing or collision were found in the ACC and were therefore classified as "other Project impacts" per Section 3.1 of the Plan. The cause of injury or mortality for the remaining 61 detections (53.0%) could not be confirmed (i.e., the carcass or feather spot displayed no signs of singeing and no direct collision effects); nearly half (27) were feather spots. All fatalities where the cause of death was collision, other Project causes, or unknown were examined microscopically for evidence of singeing injuries.

Thirty-one (27.0%) of the 115 detections consisted only of feather spots. Because singed feathers are readily observable, feather spot fatalities for which the cause of death is unconfirmed are likely to have resulted from predation, collision, or illness. The ratio of feather spots to carcasses varied considerably across the site. It was lowest in the power block (1:21), with the inner HD, inner segments, and outer segments nearer equal (1:1.2, 1:2.0, and 1:2.1, respectively). Six feather spots and no carcasses were found along the fence lines (6:0).

Summer-season carcass removal trials and searcher efficiency trials were conducted to assist in modeling the fatality estimate. Carcass persistence during the summer season ranged from less than one day, in the case of nine carcasses, to a full six-week trial period in the case of the seven carcasses whose remains persisted throughout the trial. Nine of the 11 large carcasses were detected and at least partially eaten by scavengers. In eight of these instances, the scavengers left enough of the carcass that the remains would have been detectable and considered a fatality if detected during the standardized searches. In two cases, large carcasses were removed completely. In contrast, small carcasses tended to be more completely removed, with none of the 15 small carcasses leaving remains that persisted for the entire six-week trial. Conservatively assuming that carcasses would not have persisted beyond the end of the full six-week trial period, mean carcass persistence was 4.9 days for small carcasses and 32.9 days for large carcasses. In comparison, the assumptions used in the power analysis in the Plan were 7.4 days for small birds and 21.8 days for large birds.

Searcher efficiency trials were conducted separately for humans and detection dogs. Because a large proportion of fatalities found consist solely of feather spots, searcher efficiency trials included both carcasses and feather spots. Human searcher efficiency during the summer season averaged 100% for large carcasses, 64.7% for small carcasses, and 40.0% for feather spots. Human searcher efficiency rates for both small and large carcasses were higher than target rates assumed in the Plan (which were 69% for large birds and 55% for small birds), but the searcher efficiency rates for feather spots were lower than those target rates.

Canine searcher efficiency trials were split between feather spots and carcasses for canine teams without distinguishing carcasses by size (due to the low sample size [N=3] of large carcasses used in these trials). Detection dog searcher efficiency for the summer period averaged 75.0% for carcasses (3 of 3 large carcasses detected and 12 of 17 small carcasses detected, or 15 of 20 detected overall) and 63.8% for feather spots. Canine searcher efficiency rates for carcasses were higher than the target rates assumed in the plan for both small and large bird carcasses. Canine searcher efficiency rates for feather spots were also higher than the Plan's target rate of 55% assumed for small birds.

In general, there were no obvious temporal patterns of detections during the summer survey period; however, there was one survey day, 28 May, in which 10 fatalities were detected. The majority of detections on that date were found in the tower area of Unit 3. These detections were distributed among singed, collision, and unknown detections (rather than just one mortality cause), and were likely related to late northbound migratory activity in the region.

The species composition of detections throughout the solar plant was more similar to that of the heliostat grids than to the desert bajada habitat. Four of the 10 most commonly detected birds were also among the seven avian species observed utilizing the heliostat grids. Only two of the 10 most commonly observed species in the desert bajada were also frequently detected during fatality surveys. This result is expected because birds using the heliostat grids have much more exposure, than do desert birds, to Project facilities that provide sources of collision and high flux concentrations.

During the period 23 May – 17 August 2014, there were an estimated 172 fatalities (90% confidence interval estimates 102-416) with direct evidence of singeing, collision, or entrapment. As a result of low detections (fewer than five) in the heliostat areas, and none along fence lines, no fatality estimates with direct evidence of singeing, collision, or entrapment are provided for those Project elements. A total of 169 fatalities (90% confidence interval estimates 99-413) with direct evidence of singeing, collision, or entrapment were estimated for the tower area.

According to Section 5.3 of the Plan, quarterly reports are required to categorize potential migratory bird mortality issues at Ivanpah as high, medium, or low to provide an appropriate biological basis for TAC review and decision making, based on the following definitions:

1. "High: Estimated avian mortality or injury levels are facility-caused and likely to seriously and negatively affect local, regional, or national avian populations within a particular species or group of species."
2. "Medium: Estimated avian mortality or injury levels are facility-caused and have the potential to negatively affect local, regional, or national populations within a particular avian species or group of species."
3. "Low: Estimated avian mortality or injury levels that have minimal or no potential to negatively affect local, regional, or national populations within a particular species or group of species."

The 2014 summer results indicate that the potential migratory bird mortality during this season would be categorized as low. Total detections of any one species or group represent a small proportion of local, regional, or national populations. The 115 avian detections included 36 different bird species. Of these 36 species, 27 were represented by three or fewer detections, and the nine species with more than three detections are all relatively common, widespread birds. All of these 36 species have populations that are great enough locally (either as breeders, wintering birds, or migrants), regionally, and nationally that the loss of the individuals recorded in summer 2014 would have no substantive impact on populations at any of these geographic scales. The cause of injury or mortality for 61 of the 115 detections (53.0%) is not known with certainty.

Section 2.1 of the Plan requires that "If a large portion (i.e., more than 40 percent) of the detections cannot be determined, or presumed without a reasonable doubt to be caused by the facility, potential other causes, such as unrelated avian disease or a lightning event, will be considered and the analysis adjusted as appropriate in the seasonal report.". Therefore, we considered potential factors contributing to the fatality of these unknowns. During this summer period, two avian detections without evidence of singeing or collision were found in the ACC buildings. Although the cause of death for these two birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space. We found no evidence that a large proportion of the remaining detections of unknown cause were temporally clumped (which might have suggested that discrete events such as lightning strikes or disease

events had killed multiple birds). Thirty-one of the detections of unknown cause were in Unit 3, whereas 14 were in each of the other two units, three were along fence lines, and one was along Coliseum Road. Despite the larger proportion being in Unit 3, there was no obvious reason for this distribution. Twenty-seven (27) of the 61 unknown detections were feather spots, for which the cause of death is difficult to determine. We thus concluded that there were no obvious, discrete explanations for these unknown fatalities. As a result, we did not consider it appropriate to adjust the fatality estimates based upon direct evidence to incorporate some or all of the fatalities of unknown cause, but rather, we reported the estimates separately for detections with direct evidence of singeing, collision, or entrapment and detections of unknown cause.

Of the special-status species recorded, one bank swallow (a state-listed species) was detected with singeing. Bank swallows are widespread breeders through the middle and northern latitudes of North America, and throughout the rest of the northern hemisphere. The single bank swallow detection in summer 2014 represented a very small proportion of the bank swallows expected to migrate through the Ivanpah area between wintering grounds south of the United States and breeding sites as far north as Alaska and Canada. This species' populations are estimated at 13,800,000 birds in North America and 46,000,000 individuals worldwide. The most recent estimate available of the California breeding population numbered approximately 9,590 pairs in 2003, and burrow abundance along the Sacramento River estimated at 15,000 in 2012. Thus, at scales from local/regional (i.e., migrants moving through the Ivanpah area and the surrounding region) to national to global, the bank swallow detection at Ivanpah during the 2014 summer season does not rise above the "low" category, as a loss of this magnitude would have a minimal effect on populations at any of these geographic scales. Otherwise, special-status species detections with direct evidence of singeing, collision, or entrapment included single olive-sided flycatcher and yellow warbler detections; both of these species are California species of special concern. These detections would have no substantive effect on populations of these species at local, regional, or national scales.

Table of Contents

Figures

Tables

Appendices

Section 1.0 Introduction

1.1 Project Background

The Ivanpah Solar Electric Generating System (referred to in this report as "Ivanpah" or "Project") is composed of three solar units consisting of power electrical generating facilities (Units 1, 2, and 3) with a combined net capacity of 377 megawatts. Each unit includes a central power tower with an air cooled condenser (ACC) and associated electrical generating equipment, surrounded by a heliostat array that reflects sunlight to a boiler at the top of the tower. Ivanpah is located on approximately 1,457 hectares (3,600 acres) of Bureau of Land Management (BLM) land west of Interstate 15 near Nipton in San Bernardino County, California (Figure 1). Construction was initiated in 2010 and completed in late 2013.

1.2 Monitoring Plan Overview and Goals

An Avian & Bat Monitoring and Management Plan (2013; "Plan") was prepared by the Project proponent in collaboration with the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), California Energy Commission (CEC), and Bureau of Land Management (BLM) to guide comprehensive monitoring of impacts to birds and bats associated with the operation of the facility. Final agency acceptance of the Plan occurred in November 2013. The Plan is also intended to: 1) satisfy the BLM Right-of-Way (ROW) Permit requirement that the Ivanpah team develop an avian plan as well as a Migratory Bird Treaty Act (MBTA) Conservation Agreement; 2) satisfy the requirements for the Avian & Bat Monitoring and Management Plan approved by the CEC for Ivanpah per CEC Condition of Certification BIO-21; and 3) achieve the avian and bat protection objectives of the USFWS in relation to the MBTA, Bald and Golden Eagle Protection Act (Eagle Act), and Federal Endangered Species Act (FESA), including preparing written records of the actions that have been taken to avoid, minimize, and compensate for potential adverse impacts to avian and bat species. By developing a proactive management plan in close consultation with the USFWS and other relevant state and federal agencies, project proponents can effectively comply with the intent of the federal MBTA, Eagle Act, FESA, and relevant state regulations (USFWS 2012).

The Plan details the onsite and offsite surveys to be conducted and the data analysis and reporting processes that will be implemented by Ivanpah in collaboration with the USFWS, CDFW, CEC, and BLM and supports four main goals and associated objectives. As identified in the Plan, they are:

Goal 1. Identify Collision Risks: Risks will be identified by monitoring and identifying avian mortality and injury associated with facility structure collisions.

- Objective 1. Estimate collision-related avian mortality and injury with the following facility structures, using empirical data to calculate facility-wide mortality and injury rates:

- Power towers
- Perimeter fences
- Heliostats
- Project Transmission Line (Unit 3 Collector Line)

Goal 2. Identify Solar Flux Risks: Risks from flux will be assessed by monitoring and identifying avian mortality and injury associated with solar flux generated by the facility.

- Objective 2. Estimate flux-related avian mortality and injury using empirical data to calculate facility-wide mortality and injury rates.

Goal 3. Identify Patterns of Avian Use at the Facility: Patterns of avian use will be assessed by conducting onsite and offsite surveys to document avian species composition onsite and offsite, compare abundance in representative habitats onsite and offsite, and document changes in avian use in these areas over time.

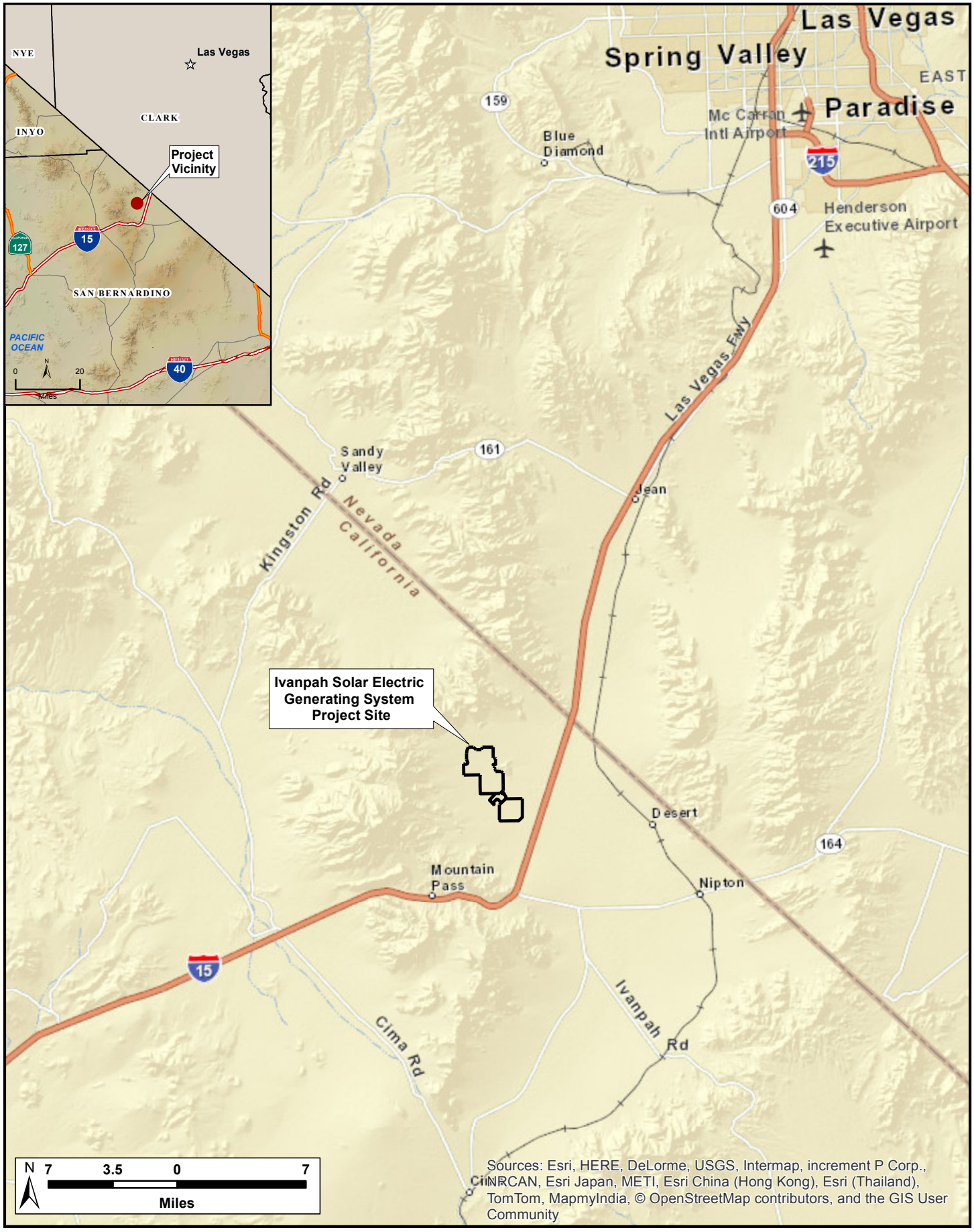
- Objective 3. Document patterns of collision- or flux-related mortality and injury associated with species, age/sex, season, weather, and visibility.
- Objective 4. Document spatial patterns associated with collision- or flux-related mortality and injury.
- Objective 7. Document use patterns of various avian species, including migratory birds, raptors, and golden eagles, particularly the seasonal variation of bird communities through breeding, migratory, and overwintering periods.

Goal 4. Provide a Framework for Management and Response to Risks: The designation and description of the functioning of the Technical Advisory Committee (TAC) provides a management and decision framework for the identification and implementation of potential adaptive management measures.

- Objective 5. Provide quantitative information for developing and implementing adaptive management responses commensurate with identified impacts.
- Objective 6. Provide a framework for the TAC to jointly review, characterize, and recommend responses, based on monitoring results, to the appropriate lead agency representatives.

1.3 Purpose of This Report

This report represents the third "quarterly" (i.e., seasonal) report summarizing monitoring methods and results for avian and bat injuries and fatalities based on the procedures and requirements specified in the USFWS-accepted Plan and as required by CEC Condition of Certification BIO-21. This report covers the 2014 summer season, which includes the period from 23 May through 17 August 2014.



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 1 Ivanpah Vicinity Map.mxd

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Figure 1: Ivanpah Vicinity Map
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

Section 2.0 Methods

The Plan describes the methods by which monitoring and certain analyses, such as compiling the overall fatality estimate, will occur. Below, these methods are described only briefly (because they are included in the Plan), with more detailed descriptions of any refinements that were necessary as the Plan was implemented in the field.

2.1 Avian Use Monitoring

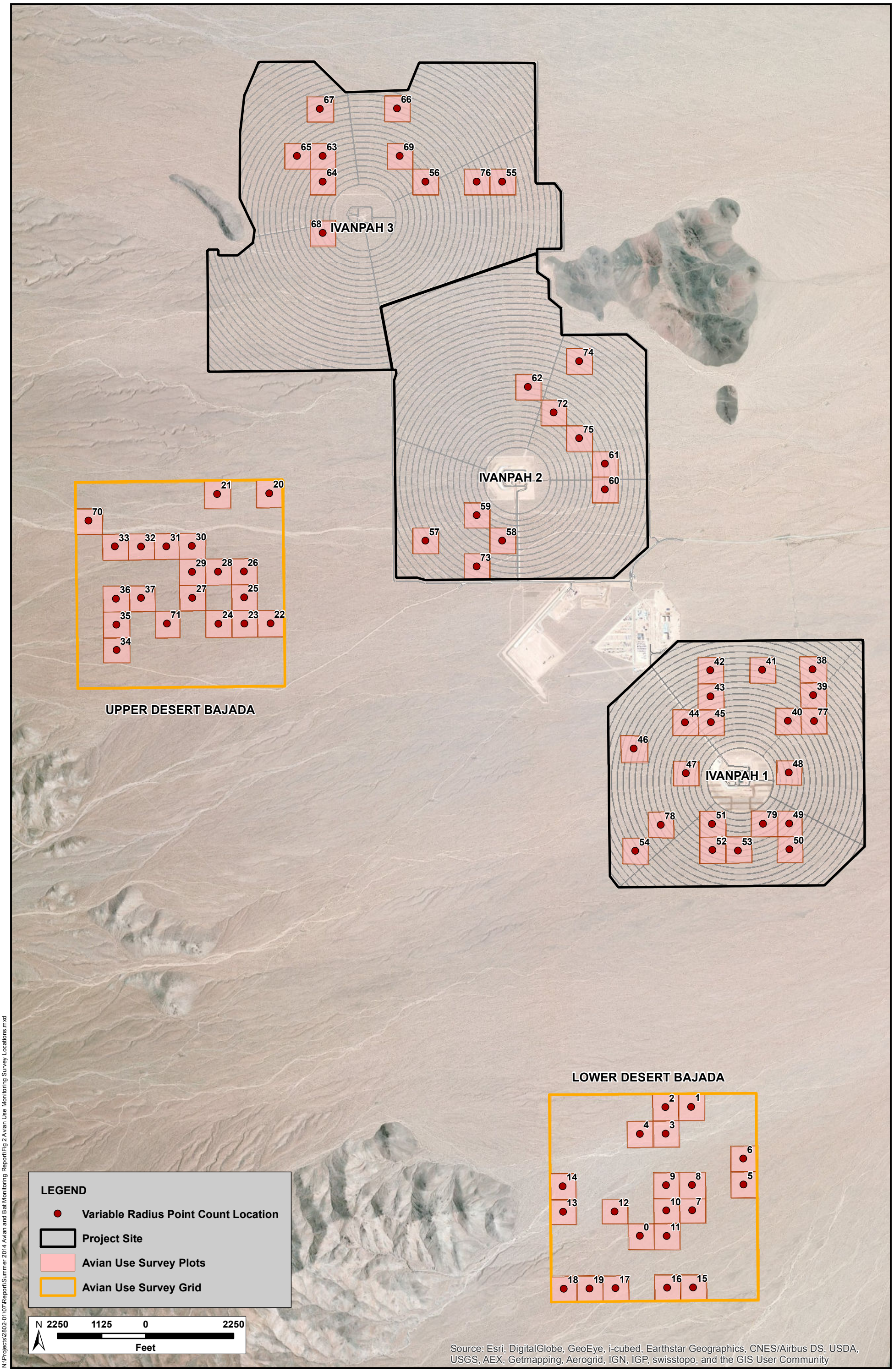
This section describes the methods for monitoring avian use of the solar plant and nearby desert areas, as well as the methods for monitoring the occurrence of raptors and other large birds on and around the facility. More than 64 hours of field observation time conducting avian use surveys and 95 hours of field observation time conducting raptor/large bird surveys were performed during the 2014 summer season.

2.1.1 Avian Monitoring Surveys

Avian use surveys were conducted using standard, variable-radius point counts to assess bird use of the vegetated areas within the heliostat fields and nearby offsite areas within desert habitats. Eighty survey points (Figure 2) were surveyed a total of three times each during the summer period by a CEC- and BLM-approved avian ecologist. In accordance with the Plan, these 80 points were randomly selected from within the following five study areas:

1. 20 points within an approximately 2.59 square-kilometer (1-square-mile) study area located in Unit 1, within the lower bajada environment of the facility.
2. 20 points within an approximately 2.59 square-kilometer offsite study area located in comparable lower bajada environment as far as practicable from (and south of) the Unit 1 fence line.
3. 10 points within an approximately 1.29 square-kilometer (0.5-square-mile) study area located in Unit 2, within the upper bajada environment.
4. 10 points within an approximately 1.29 square-kilometer located in Unit 3, in the upper bajada portion of the facility.
5. 20 points within an approximately 2.59 square-kilometer offsite study area located in comparable upper bajada environment and as far as practicable from (and southwest of) the Unit 3 fence line.

Each of the survey areas described above was divided into 200-m by 200-m square areas to define distinct sample plots. Within each study area, either 10 or 20 (as indicated above) avian use survey points were randomly selected from the sample plots, resulting in 20 point counts per 2.59 square kilometer for each habitat type in the facility and control areas, with each count location affording a minimum, non-overlapping survey radius of 100 m. Our 2014 winter and spring season surveys were conducted according to Figure 8 on



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 2 Avian Use Monitoring Survey Locations.mxd

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Figure 2: Avian Use Monitoring Survey Locations
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

Page 25 of the Plan, which is inconsistent with the text on Page 23 of the Plan because Figure 8 depicts 20 points in Unit 3 and zero in Unit 2. Starting in the summer of 2014, we adjusted our approach for avian surveys to reflect the text on Page 23 of the Plan by randomly selecting 10 of the 20 points in Unit 3 that we surveyed in the 2014 winter and spring seasons, excluding those from future surveys, and randomly selecting 10 points to survey within a grid in Unit 2. Thus, the 2014 summer surveys were consistent with the text of the Plan.

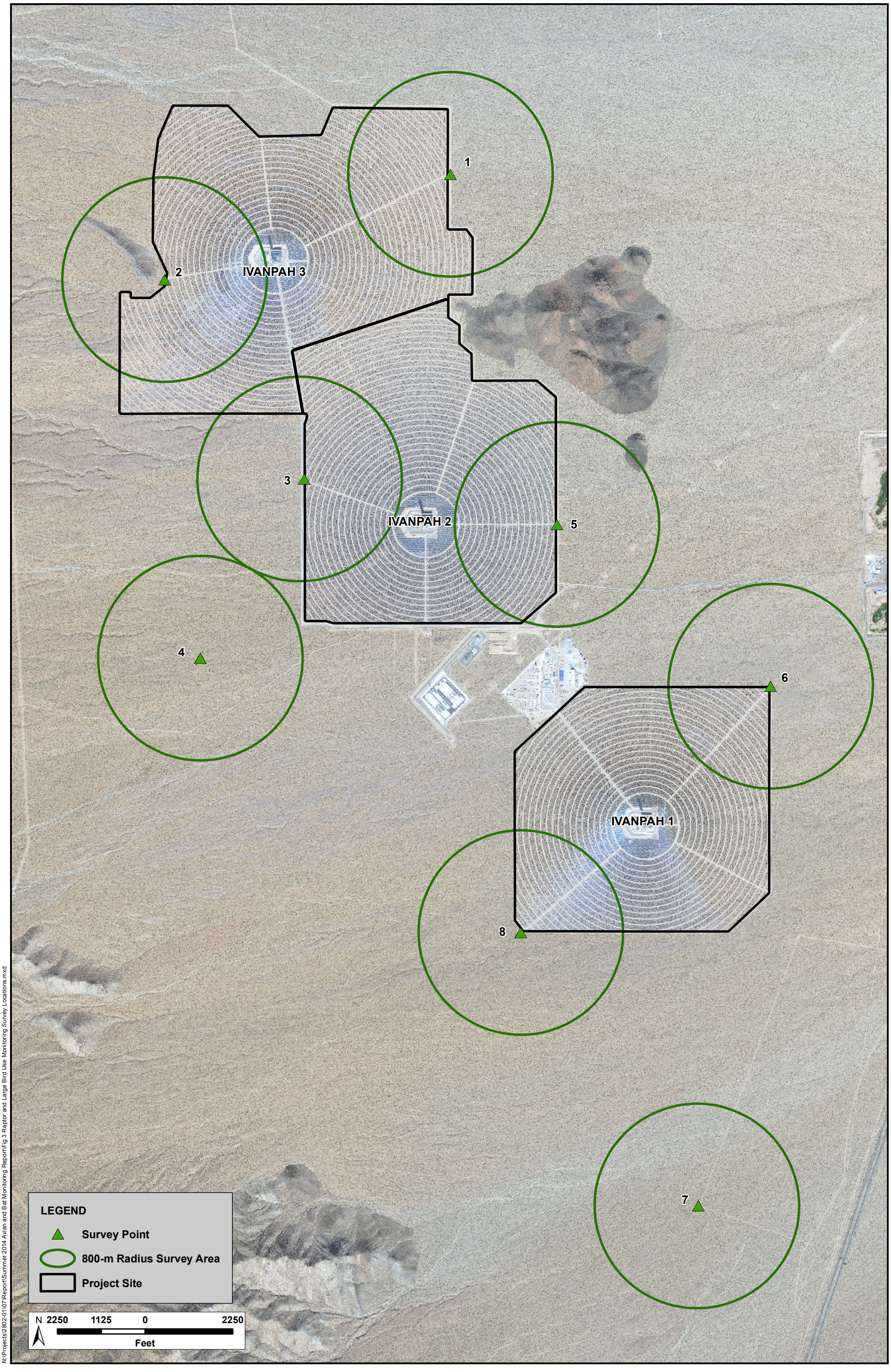
The Plan specifies that avian use surveys are to be conducted once per month during June-August. In accordance with this schedule, we conducted a total of three surveys (one each in June, July, and August) for the 2014 summer season.

Using distance-sampling techniques such as variable-radius point count methods, determination of bird densities is not as straightforward as simply calculating the mean number of individuals observed in each survey area (Buckland et al. 1993). Rather, the density distributions of the survey data (i.e., assessing density as a function of distance from each point) have to be considered in determining densities. Determining such density distributions typically requires a fairly large amount of data, especially when using programs such as Distance 6.0 (Thomas et al. 2010) to estimate bird densities. Due to the low number of individuals of any given species recorded during these surveys (owing to the naturally low abundance of summer birds in the habitats surveyed), it was not possible to obtain reliable density estimates on a species-by-species basis for the 2014 summer season. Even when data were pooled within a 20-point grid, sample sizes were insufficient to allow for determination of reliable density estimates within a grid (e.g., to allow for comparisons between one 20-point heliostat grid and the other, or between one 20-point desert habitat control grid and the other). However, when data from the 40 heliostat points were pooled, and data from the 40 desert points were pooled, overall sample sizes for the heliostat arrays vs. the offsite desert habitats were large enough to provide reliable density estimates in each of these two categories (onsite and offsite) using the program Distance 6.0. These comparisons are appropriate per the Plan, which states that avian use studies will concentrate on species composition and abundance, with a focus on comparison between the on- and offsite areas.

As confirmed with the TAC, the Plan does not require the species to be categorized based on resident/migrant and foraging guilds, as provided in the prior reports, so that analysis is not included.

2.1.2 Raptor/Large Bird Monitoring Surveys

Surveys for raptors and other large birds were conducted from each of eight points as identified in the Plan and shown on Figure 3. These surveys were conducted using unlimited-distance point counts to assess use of the facility and offsite study areas. CEC and BLM-approved avian ecologists performed these surveys using binoculars and spotting scopes to identify raptors and other large birds, such as gulls (*Larus* spp.) and common ravens (*Corvus corax*), observed during a 4-hour survey period. The Plan specifies that surveys for raptors and other large birds be conducted once per month during summer; thus, three surveys were conducted at each point, with one each in June, July, and August.



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 3 Raptor and Large Bird Use Monitoring Survey Locations.mxd

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Figure 3: Raptor and Large Bird Use Monitoring Survey Locations
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

2.2 Facility Monitoring

This section describes areas surveyed, the timing and frequency of the searches, and the methods by which standardized searches were conducted to identify dead and injured birds and bats at the facility. This section also describes the methods for conducting carcass removal and searcher efficiency trials; how data were reported and analyzed for incidental detections; and the methods for producing fatality estimates for the facility. Not including any data management or analysis, approximately 1,380 person-hours were spent conducting standardized monitoring searches and performing carcass removal and searcher efficiency trials during the 2014 summer season. In addition, standardized surveys by scent detection dog teams began in the summer, with approximately 230 handler-hours and 127 canine-hours spent conducting standardized monitoring searches and performing searcher efficiency trials.

2.2.1 Standardized Searches

2.2.1.1 Areas Surveyed

Per the Plan, monitoring searches were conducted in the "tower area", defined as the power block (the area consisting of the tower, the ACC unit, the associated control building, and immediately adjacent areas defined by the ring road and berm/slopes surrounding these facilities) and inner high-density (HD) heliostats surrounding each power block (100% survey coverage); the "heliostat area", defined as the inner and outer heliostat segments outside of the inner HD heliostats (24.1% survey coverage in randomly selected arc-shaped plots); the "fence line" defined as the perimeter fences (100% survey coverage); the "collector line", defined as the Unit 3 Collector Line (100% survey coverage); and offsite control areas. Table 1 provides the acreage searched within each of these areas, as well as the percent of the facility comprised by these search areas. Overall, approximately 29.2% of the facility (not including the offsite control area, which is outside the facility) was searched. All these areas are depicted on Figure 4.

To ensure a balanced distribution of heliostat field survey plots, we divided each unit into inner and outer heliostat fields, and randomly selected approximately 20% of each sub-area. This stratified random sampling design ensures that survey plots will not be clustered or biased in any distance or direction from the towers.

Table 1. Monitoring Areas, 23 May – 17 August 2014.

Area	Acreage Searched (ac)	Percent of Facility
Tower Area	154	4.8%
Heliostat Area	720	22.4%
Fence line	39	1.2%
Collector Line	26	0.8%
Offsite Control Area	7	NA*
Total Search Area	**939**	**29.2%**

* NA = Not applicable, because the offsite control areas are located outside the facility

2.2.1.2 Search Frequency and Timing

Although the summer survey season began 23 May (i.e., any detections reported 23 May or later would have counted as "summer" detections), standardized summer fatality searches began 28 May for Unit 3, 2 June for Unit 2, and 9 June for Unit 1. The timing of searches was staggered among the three units to ensure that surveys began approximately 21 days following the last spring survey of each unit. According to the Plan, summer searches of each area were to be conducted at intervals of no more than 25 days. The average 2014 summer search interval was 21.0 days (range 18 to 23, median 21 days) for the three solar units. This variation is expected to occur, and as indicated in Section 3.1.1 of the Plan the fatality estimator (Huso 2010), is designed to accommodate slight variability in the search interval by incorporating the exact interval for each search to develop an average interval between standardized removal surveys, in days.

Each unit's power block, inner HD heliostats, outer segment arc plots, and fence were surveyed four times during the summer season. One survey of a single Unit 3 control transect was cancelled due to safety concerns related to lightning, so this area was searched three times during the summer season; the remaining control transects were surveyed four times during summer.

2.2.1.3 Search Methods

Methods Used by Human Searchers. Human searchers performed surveys in the tower area, fence lines, control transects, Unit 3 collector line, inner segment arc plots, and those outer segment arc plots that were not surveyed by dogs (as described below). Standardized searches for fatalities were performed by CEC and BLM-approved biologists conducting walking surveys in accordance with the methods outlined in the Plan. We found that searcher efficiency was enhanced when a pair of searchers walked a total of four transects oriented longitudinally along the complete length of each arc plot, with the ring roads serving as the outer boundaries of each arc plot (Figure 5). Because searcher efficiency was enhanced in accordance with the goals of the Plan, this refinement was implemented, and will continue to be implemented, as the standard approach throughout the Project site in lieu of the initially proposed pattern in the Plan (as it was also during the winter and spring surveys). While walking each transect, searchers walked a narrow search section approximately 10 meters (m) wide.

Otherwise, searches were performed exactly as described in the Plan. Within the heliostat area, 24.1% of each heliostat field was surveyed using randomly distributed 2.02-hectare (5-acre) arc plots. Within the power block, biologists walked through and around the tower and ACC unit looking for dead and injured birds and bats, and walked transects through the gravel surrounding the structures to achieve 100% coverage within physically accessible areas. Within the inner HD heliostats surrounding each power block, biologists walked transects to ensure 100% coverage. Thus, the tower area, comprising the area within 260 m of each tower, was completely covered during each survey. Along the fence line, a 6-m wide transect was surveyed, centered on the fence itself (i.e., 3 m on either side of the fence). The Unit 3 Collector Line was surveyed using a 30-m wide transect (i.e., 15 m on either side of the center line). Offsite surveys were conducted along two randomly selected 152-m long control areas, separated by approximately 10 m extending outward from the perimeter

N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 4 Ivanpah Search Areas.mxd

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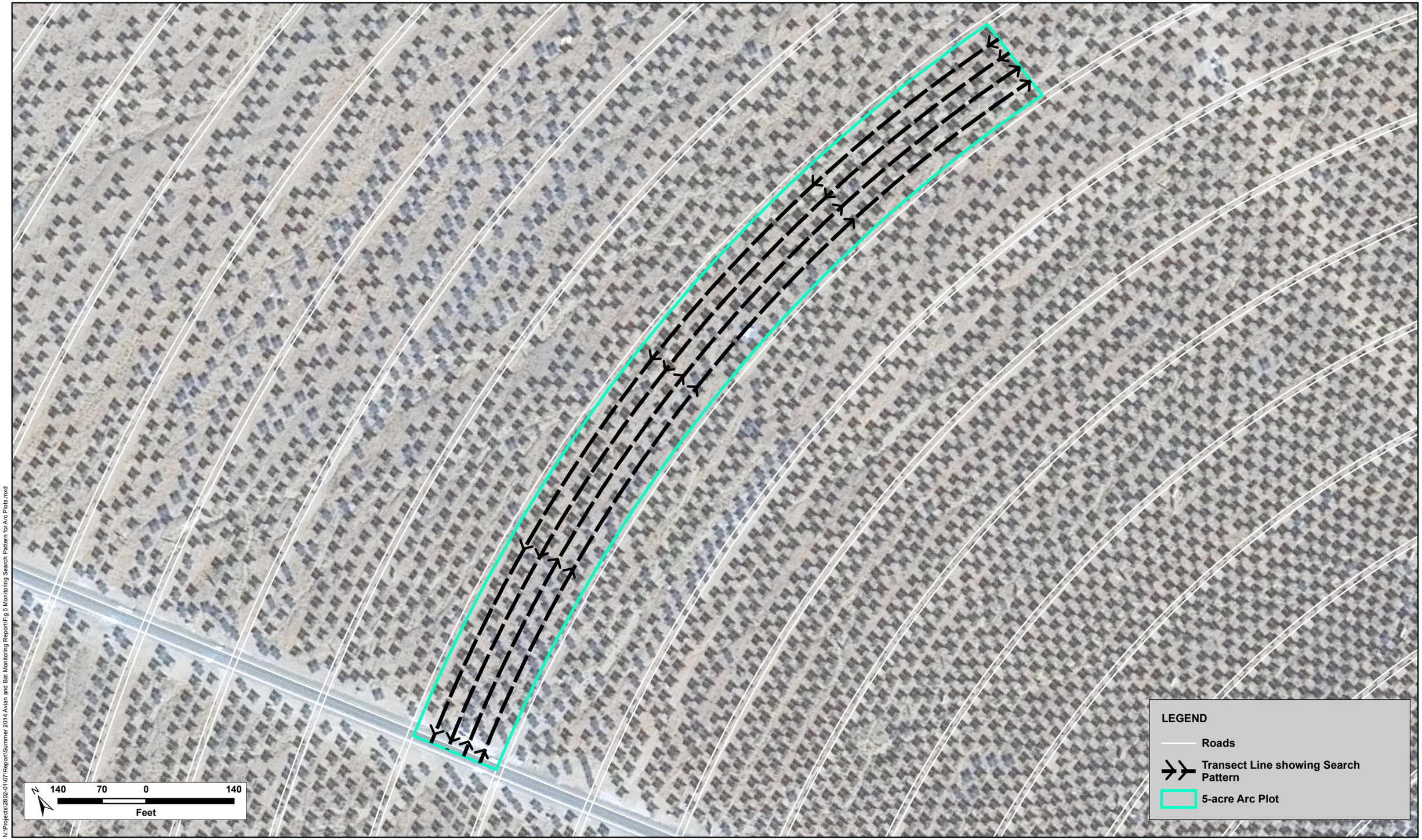
Figure 4: Ivanpah Search Areas
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 5 Monitoring Search Pattern for Arc Plots.mxd

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Figure 5: Monitoring Search Pattern for Arc Plots
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

fence and back to the facility at nine locations, including the north, east, south, and west borders of the facility.

Methods Used by Detection Dog Teams. Detection dog surveys were performed using canines extensively trained to detect, and passively alert their handlers to, the presence of feathers (including avian carcasses). Search patterns differed from the visual-only patterns used by qualified human searchers. Handlers used body movements and verbal signals to direct the dog's movements relative to wind speed and direction to ensure full coverage of the survey area. As a result, the dog started its search downwind of the intended survey area at a distance appropriate for the wind speed/direction at the discretion of the handler and worked in an upwind direction. Transect spacing employed depended on wind speed, with closer spacing in light wind and wider spacing in relatively strong wind. Handlers directed detection dogs to increase their search intensity in areas of high habitat complexity (e.g., uneven ground, washes, and thick vegetation) where scents can pool and become "trapped." As each team moved through the survey area, the dog ranged and quartered (i.e., moved ahead and side to side) ahead of the handler, searching for avian detections. Once the target was confirmed, the dog received a reward. Avian fatalities were marked and collected by CEC and BLM-approved biologists.

Detection dog surveys began in the summer period. Dogs surveyed a subset of the outer segment arc plots. Initially, detection dog teams surveyed a total of five arc plots in Unit 1, 10 arc plots in Unit 2, and nine arc plots in Unit 3. Additional arc plots were surveyed by detection dog teams over time. Once an arc plot had been surveyed by a dog team, that plot continued to be surveyed by detection dogs for the remainder of the summer period. At no time was an arc plot that had been surveyed by detection dogs subsequently surveyed by humans during the summer. Table 2 below summarizes the numbers of arc plots surveyed by detection dogs over the summer.

Table 2. Numbers of Arc Plots Surveyed by Detection Dog Teams.

Unit	Number of Plots Surveyed Four Times	Surveyed Three Times	Surveyed Two Times	Total Plots Surveyed
1	4	7	0	11
2	10	0	1	11
3	9	4	0	13

Carcass and Feather Spot Examination. Every carcass and feather spot was examined visually by a CEC and BLM-approved biologist for any signs of singeing or collision-related effects. When no obvious signs of singeing were evident, the carcass or feather spot was then examined using an AmScope SE306R-AZ-E2 20X-40X-80X Digital Binocular Stereo Microscope to detect any inconspicuous evidence of singeing. When singed detections involving carcasses (as opposed to only feather spots) were found, singeing was assigned a grade based on Kagan et al. (2014), as follows.

- Grade 1 – curling of less than 50% of the flight feathers
- Grade 2 – curling of 50% or more of the flight feathers
- Grade 3 – curling and visible charring of contour feathers

Kagan et al. (2014) originally found no singeing of contour feathers in the absence of curling of 50% or more of the flight feathers. In contrast, we have found singeing of contour feathers with curling of less than 50% of flight feathers, and in the absence of curling or singeing of any flight feathers. We therefore assigned grade 3 independent of grades 1 and 2.

Surveyors also looked for evidence of collision, including obvious physical trauma or detection adjacent to a heliostat with a bird-strike imprint, smudge mark, and/or feathers on or near the surface of the mirror. If there was no evidence of entrapment, collision, or singeing (e.g., charring, curling, or melting of feathers), as confirmed through microscopic examination, the cause of injury or fatality was listed as "unknown".

For the purpose of these surveys, feather spots were considered detections when they consisted of at least two or more primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller (Smallwood 2007), without any bone, beak, or significant amounts of flesh or skin. In some cases, an individual detection was broken up into aggregations of feathers that would meet the criteria for a feather spot, but with pieces of the carcass that contained bone or significant amounts of flesh or skin also present. In these cases, the detection is categorized as a partial carcass (rather than a feather spot), per the "feather spot" definition above. However, to correctly account for searcher efficiency in the model, when partial carcasses are initially identified as feather spots by the observer in the field, they are modeled (in the fatality estimates) as a feather spot. In other words, the primary means of identification of the detection (feather spot or carcass) is the appropriate classification to utilize in the modeled estimates. The primary identification approach is appropriate since different searcher efficiency rates are estimated for feather spots as opposed to carcasses. Such rates differ due to differences in detectability of carcasses vs. feather spots, and because searcher efficiency is an important component of the fatality estimator, what the surveyors detect first (i.e., feathers meeting the definition of a feather spot or an obvious complete or partial carcass) influences how that detection should be included in the model. Such detections are noted in Appendix A as "partial carcass + feather spot" in the "Description of Carcass/Injury" column.

2.2.2 Carcass Removal Trials

In accordance with the Plan, we set out carcasses approximately weekly for carcass removal trials. We were authorized to use only non-native species for both carcass removal trials and searcher efficiency trials (discussed below), as per the terms of the USFWS Special Purpose Utility (SPUT) permit. Therefore, we used four species of non-native birds: European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), rock pigeons (*Columbia livia*), and ring-necked pheasants (*Phasianus colchicus*). We classified bird size as follows: $\leq$100 grams (g) were classified as small, and >100 g were classified as large. As a result, European starlings and house sparrows, which average <100 g, were used to represent small birds, while rock pigeons and ring-

necked pheasants, which are >100 g, were used to represent large birds. We conducted 26 carcass removal trials during the 2014 summer season, using a total of 11 large carcasses and 15 small carcasses. Because carcass removal rates on the power block likely differ from removal rates elsewhere on the Project facilities, we conducted carcass removal trials on the power block during the summer survey period. Seven carcasses, three large and four small, were placed on the power block. Seventeen carcasses (seven large and 10 small) were placed in other surveyed areas of the facility (i.e., inner HD area, inner and outer segment heliostats, fence lines, and the Unit 3 collector line). The remaining two carcasses, one small and one large, were placed along the off-site control transects.

We conducted carcass removal trials in accordance with the Plan and applicable permits. Consistent with all the prior monitoring periods, monitoring for carcasses included looking for any feather spots resulting from those placed carcasses that were left behind after scavenging. Because feather spots often persist for searchers to find long after scavenging, monitoring both feather spots and carcasses provides a more accurate measure of persistence.

2.2.3 Searcher Efficiency Trials

Human Searcher Efficiency Trials. In accordance with the searcher efficiency trials described in the Plan, we placed a total of 33 carcasses (14 large and 19 small) during the summer season for human searcher efficiency trials. Because a number of the detections found during searches have been feather spots, and these detections may differ from carcasses in detectability, we also placed 25 feather spots. Carcasses and feather spots were placed in various vegetation heights and in areas that had different soil and vegetation colors and values to represent the range of conditions under which searches occur. They were placed in all areas where fatality monitoring occurs (i.e., the tower area, fence lines, control transects, Unit 3 collector line, and inner and outer segment arc plots).

Two of the small carcasses and three of the large carcasses disappeared (e.g., they may have been scavenged) before the searcher efficiency trial began, leaving a sample size of 17 small and 11 large carcasses and 25 feather spots included in the human searcher efficiency trials.

Detection Dog Searcher Efficiency Trials. During the summer period, carcasses and feather spots were placed throughout arc plots surveyed by canines to determine the searcher efficiency of detection dog teams. To ensure that human handlers' knowledge of the locations of searcher efficiency carcasses did not bias the results, only blind searches (i.e., those in which handlers did not know the carcass locations) were used to determine canine searcher efficiency.

During the 2014 summer season, 17 small carcasses, three large carcasses, and 130 feather spots were used in blind detection dog searcher efficiency trials. These carcasses and feather spots were placed in locations with various vegetation heights and in areas that had different soil and vegetation colors and values to represent the various conditions under which searches occur.

2.2.4 Incidental Reporting

Some detections (defined as a dead or injured bat or bird) were outside standardized search areas, or were within search areas but not during standardized searches. Such detections were found by H. T. Harvey & Associates staff, the Project's designated biologists, or operational personnel. These detections, which were reported in accordance with the facility's Wildlife Incident Reporting System described in Section 3.4 of the Plan, were considered "incidental" detections. Thus, an "incidental detection" is a bird or bat found dead or injured in a time or place other than the standardized searches that are conducted according to the Plan. Data on such birds and bats were collected separately and reported in the SPUT permit database. As described in Section 2.2.5, incidental data were included in the fatality estimates when they were found in areas covered during standardized surveys (e.g., in the tower area and along the fence line), during time periods in which those areas were being searched. Incidental detections from outside the survey areas are not included in the fatality estimates.

2.2.5 Fatality Estimator

Animals die at an unknown rate which must be inferred from regular searches of a site. Carcasses also persist for varying amounts of time and are imperfectly detected by searchers. For these reasons, it is often inappropriate to draw conclusions based on the raw number of fatalities in an open system. The desire to estimate fatalities given these variables has driven the development of several statistical methods for estimating fatalities (e.g., see Johnson et al. 2003, Smallwood 2007, and Huso 2010). All of these fatality estimation methods share a similar underlying model. Generally, the fatality estimation for a given site may be written as:

$$F=C/rp,$$

where the number of fatalities, F, is the quotient of the number of carcasses detected, C, over the product of carcasses left unscavenged, r, and the proportion that an observer sees, p (Huso 2010).

The inputs for r and p are estimated in subgroups of covariates that will influence the detectability and persistence of each carcass, such as carcass size, vegetation height, and stage of decay or scavenging (i.e., feather spot versus carcass). Given the tendency for many fatality models to underestimate site-wide fatalities, we chose to use a fatality estimator written by M. Huso (2010), which was shown to outperform previous fatality estimation models by more accurately accounting for imperfect detectability. This model, *The Fatality Estimator*, was developed to estimate fatalities primarily for wind energy projects; however, it can be applied to other sources of fatalities including power lines and solar projects (Huso 2010). The estimator uses this conceptual framework of fatalities, combined with bootstrapping from models of r and p to calculate variances and confidence intervals for the estimates of fatalities. Bootstrapping is a statistical method used to create a distribution to assign measures of variance to estimates for data where the underlying distribution is either unknown or cannot be represented algebraically (Efron and Tibshirani 1986). Bootstrapping resamples

the data with replacement, several thousand times, to create a distribution that may be used to infer information about the sample mean.

Estimating Carcass Removal Times. Measurements of carcass removal rates typically include one or more censoring values. A censoring value is used in statistics when a value is only partially known. For example, if a carcass was checked on day 7 and was present, and was checked again on day 10, but was found to be missing, then the date of scavenging is unknown, and an interval censor would be used. Because we used camera traps, the majority of scavenging times were known precisely, and the data were not censored. However, when cameras failed to record the moment of scavenging, we applied interval censoring.

There are four commonly used distributions of survival models that can be used in the fatality estimator for a value of *r:* exponential, Weibull, loglogistic, and lognormal. These four distributions have different rates and shapes of decay curves that attempt to model the survival of carcasses over a given search interval. We used Akaike's Information Criterion adjusted for sample size (AICc; Akaike 1973) to rank the fit of each survival model to our carcass removal trial data. Because the exact time of death for detected fatalities is usually unknown, the probability of persistence cannot be calculated exactly for each carcass, but it can be estimated from the selected survival model and bootstrapped to obtain a range of estimates of *r* for each carcass.

Estimating Searcher Efficiency. Searcher efficiency, or the proportion of fatalities that an observer sees, p, is represented most simply by the following equation:

$$p = \frac{NumberObserved}{NumberAvailable}$$

Because the 2014 summer season was the third season in which searcher efficiency trials were performed at Ivanpah, the sample size is not yet large enough to allow us to fully investigate the effects of variables such as bird size and vegetation cover, but these variables will be examined in future seasons as the sample size increases.

Fatality Estimates. Per Section 3.1 of the Plan, we report estimates for the tower area components (i.e., the power block and inner HD heliostats) together, because 100% of this area was searched; however, these estimates were calculated separately for the power block and inner HD heliostats due to the inclusion of many more incidental observations from the power block. We ran a separate estimate for the heliostat area (the inner and outer heliostat segments combined), in which 24.1% of the total area was searched.

The ACC buildings are only marginally accessible to scavengers from the outside; therefore, they act primarily as a closed system with a scavenging rate that approaches zero. Because of this, we did not use the fatality estimator equation to determine the numbers of fatalities at the ACC buildings; rather, we added the raw numbers from the ACC buildings, which we believe are representative of the fatality population within the ACC buildings, to the results of the fatality estimator to produce the overall fatality estimates for the tower

area. All detections within the ACC buildings were assigned as having a known cause of fatality, whether or not they showed evidence of singeing or collision, because they represented entrapment.

Within the power block, a large percentage of the detections were found incidentally. Incidentals are typically not included in fatality estimates due to the sporadic, unpredictable nature of such reports and unaccounted-for search effort. However, because these detections accounted for a moderate proportion of the detections recorded during the 2014 summer season, we included them in our estimates for the power block. We adjusted the search interval for incidental detections on the power block to one day to reflect the high human use in these areas and thus the high probability that monitoring or operational personnel would see and report any highly visible fatality in these areas. There were also two incidental detections outside of the power block (one in the inner HD area and one in an outer-segment arc plot in the heliostat fields), but within the standardized search areas, which were included in the fatality estimates. For these detections, the survey interval was defined as the number of days between the date of detection and the date of the previous regular standardized survey (i.e., the same approach used for detections found during standardized surveys).

Because of the carcass removal policies within the power block, no carcass removal trials were conducted in that area during the winter or early spring period. A change in this policy allowed carcasses to be placed on the power block for carcass removal trials beginning in the late spring season, and carcass removal trials were conducted in the power block during the summer period as well. Owing to low carcass removal trial sample sizes in any single component of the Project site (e.g., the power block, or the inner/outer heliostat segments), carcass removal values for all Project areas were pooled and averaged, and the mean carcass removal rates were used in all fatality estimates.

Because the fatality estimator is not appropriate for estimating rare events, we only present estimates for Project elements or groupings of more than five detections. The fatality estimator accounts for imperfect searcher efficiency, so fatalities that are not detected during a given search are still represented statistically. Because of this, if a previously missed fatality is detected on a subsequent search, it will essentially be double-counted, and cause the overall fatality estimate to be falsely inflated. Therefore, any detections determined to be significantly older than the search interval were removed from the estimator (Huso 2010). Because of uncertainty in estimating the ages of detections (i.e., the length of time between a bird's death and when the detection was discovered), all detections that were entered into the SPUT database as being <1 month old were considered to be within the search interval for 2014 summer surveys. We took both the previous search interval (averaging 21.0 days) and the estimated age of individual carcasses into account in determining which detections to exclude on the basis of being older than the search interval. In addition, we excluded detections found outside of the standardized survey plots, as the fatality estimates focus on areas that are covered during standardized surveys.

Section 3.0 Avian Use and Raptor/Large Bird Monitoring Surveys

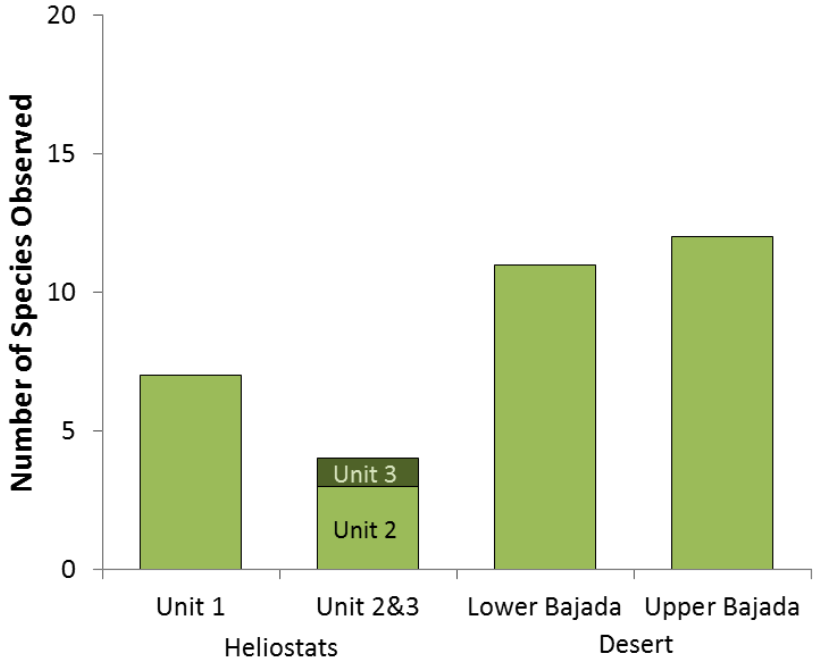
3.1 Avian Use Monitoring

This section provides the results of monitoring of avian use of the heliostat arrays and offsite desert bajada plots, including species composition and abundance. Species composition is compared between these avian use survey results and detections during standardized monitoring surveys. More than 64 hours of field observation time were spent conducting avian use surveys during the 2014 summer season.

3.1.1 Species Composition

A total of 19 bird species were recorded during avian use surveys during the 2014 summer season. Table 3 lists these species and the frequency of occurrences (i.e., number of individuals detected) within the five survey grids. As indicated by Figure 6, species richness was highest in the upper bajada desert (12 species), followed closely by the lower bajada desert (11 species). Species richness was much lower in the heliostat grids, with seven species observed in Unit 1, four in Unit 2, and one in Unit 3. In Figure 6, overall species richness is pooled for the 20 survey points in Units 2 and 3 so that each bar represents a total of 20 survey points (for the purpose of visual comparison of results). Statistical tests for differences in species richness among the five survey grids would not be appropriate because of the high number of zero values in the samples.

Figure 6. Number of Bird Species Recorded at Avian Survey Points on Five Survey Areas.



Although all birds observed during surveys were recorded, only individual birds using the survey plots were included in these analyses. These included birds that were perched on a plot or aerial foragers (such as raptors) that appeared to be foraging on the plot. Birds that were only observed flying over or through the plot were not included in the analysis, both because these birds' occurrence did not signify use of a particular area and because inclusion of birds transiting over a plot would result in substantial problems associated with spatial autocorrelation of results (e.g., as birds are observed flying through multiple plots).

3.1.2 Avian Abundance

As with species richness, avian abundance was similar on the two desert bajada grids (142 observations on the lower bajada and 140 observations on the upper bajada). The three heliostat arrays had substantially lower avian abundance, with only 28 observations in Unit 1, 15 observations in Unit 2, and one observation in Unit 3 during the summer period (Figure 7). As in Figure 6, data for the 20 plots in Units 2 and 3 were pooled for Figure 7.

Figure 7. Number of Bird Observations Recorded at Avian Survey Points on Five Survey Areas.

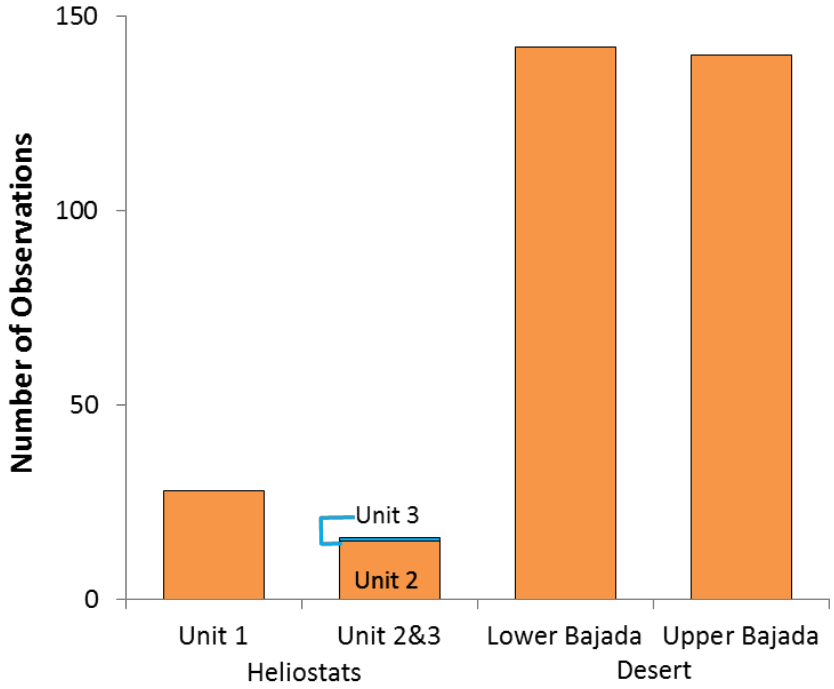


Table 3. Avian Use Survey Results - Frequency of Occurrence by Species and Survey Grid.

Common Name	Scientific Name	Unit 1	Unit 2	Unit 3	Lower Bajada	Upper Bajada
Black-throated Sparrow	*Amphispiza bilineata*	7	8	0	81	66
Cactus Wren	*Campylorhynchus brunneicapillus*	0	0	0	25	37
Loggerhead Shrike	*Lanius ludovicianus*	1	3	1	3	9
Blue-gray Gnatcatcher	*Polioptila caerulea*	0	0	0	10	3
Gambel's Quail	*Callipepla gambelii*	0	0	0	9	0
Ash-throated Flycatcher	*Myiarchus cinerascens*	0	0	0	3	5
Le Conte's Thrasher	*Toxostoma lecontei*	0	0	0	1	7
Horned Lark	*Eremophila alpestris*	7	0	0	0	0
Unknown Passerine		3	0	0	0	4
Brewer's Sparrow	*Spizella breweri*	0	0	0	5	0
Common Raven	*Corvus corax*	4	0	0	0	0
House Finch	*Haemorhous mexicanus*	1	2	0	0	0
Unknown Swallow		1	2	0	0	0
Ladder-backed Woodpecker	*Picoides scalaris*	0	0	0	2	1
American Kestrel	*Falco sparverius*	1	0	0	0	1
Bewick's Wren	*Thryomanes bewickii*	0	0	0	2	0
Lesser Nighthawk	*Chordeiles acutipennis*	0	0	0	0	2
Tree Swallow	*Tachycineta bicolor*	2	0	0	0	0
Unknown		1	0	0	0	1
Verdin	*Auriparus flaviceps*	0	0	0	1	1
Crissal Thrasher	*Toxostoma crissale*	0	0	0	0	1
Greater Roadrunner	*Geococcyx californianus*	0	0	0	0	1
Unknown Gnatcatcher		0	0	0	0	1
		28	**15**	**1**	**142**	**140**

Survey areas were identical for three of the four grids (20 points in each grid). Two grids, those in Units 2 and 3, contained only ten points each. To allow comparison among areas, and because these two grids contained similar habitats, we present observations from Units 2 and 3 together. Thus, comparison of general avian

abundance metrics such as total observations, as was done above, is appropriate for elucidating relative abundance, both overall and by species. However, because the relative abundance of various species differed among grids, and bird detectability may vary among species, assessing relative abundance using raw numbers may result in inaccurate conclusions. As a result, we used the program Distance 6.0 (Thomas et al. 2010) to evaluate avian densities. As discussed in Section 2.1.1, distance sampling analysis requires a fairly large amount of data, and due to the low number of individuals of most species recorded during these surveys (owing to the naturally low abundance of summer birds in the habitat surveys), it was not possible to obtain reliable density estimates on a species-by-species basis. Even when data were pooled within a 20-point grid, sample sizes were insufficient to allow for determination of reliable density estimates within a grid (e.g., to allow for comparisons between the two 20-point heliostat grids or the two 20-point desert habitat control grids). However, under the assumption that the two heliostat grids were more similar to each other (in terms of habitat and summer bird communities) than to either of the desert bajada grids, and making the same assumption with respect to the two desert bajada grids, we pooled data from the 40 heliostat points and compared bird densities to data from the 40 pooled desert bajada points. The 95% confidence intervals around density estimates for each habitat type did not overlap, thus providing statistical evidence that bird density in the desert bajada was significantly higher than bird density in the Heliostat Units (Table 4).

Table 4. Avian Density Estimates for Heliostat vs. Desert Bajada Grids (Derived Using DISTANCE).

		95% Confidence Interval		
Habitat Type	**Density Estimate (Birds/Hectare)**	**Low Estimate (Birds/Hectare)**	**High Estimate (Birds/Hectare)**	**Percent Coefficient of Variation**
Heliostat Units	0.5	0.3	1.0	32.7
Desert Bajada	3.1	2.5	4.0	12.6

3.1.3 Comparison of Avian Use Survey Results to Fatality Detections

Whereas 19 bird species were recorded during avian use surveys, 36 species were recorded as detections during standardized fatality monitoring (described in Section 4). Comparison of the most abundant bird species that were recorded on the avian use surveys to the species most frequently recorded as detections reveals greater similarity between detections and birds using the heliostat grids (as identified during avian use surveys) than between detections and birds using the desert bajada habitats (Table 5). Of the 10 identified species most frequently recorded as detections, four species (black-throated sparrow, horned lark, house finch, and tree swallow) were among the most abundant species on the heliostat survey grids, while two species (black-throated sparrow and lesser nighthawk) were among the most abundant species on the desert bajada survey grids. Black-throated sparrows were the most frequently observed species in both the heliostat and desert grids. These birds were also frequently recorded as detections, comprising 9.6% of all detections. Mourning doves, which were the most frequent fatality detection (13.0%), were not recorded during avian use surveys in summer but were occasionally observed in heliostat areas during fatality surveys. Greater

roadrunners were rarely observed during counts, but this ground-running species is particularly difficult to observe in the local desert scrub habitat, and the likelihood of detection within a survey area during the survey period is low.

Table 5. Comparison of the Most Abundant Bird Species Recorded as Detections and Recorded on Heliostat and Desert Bajada Survey Grids.

Detections[1]	Heliostat Survey Grids[2]	Desert Bajada Survey Grids
Mourning Dove	Black-throated Sparrow	Black-throated Sparrow
Black-throated Sparrow	Horned Lark	Cactus Wren
House Finch	Loggerhead Shrike	Blue-gray Gnatcatcher
Lesser Nighthawk	Common Raven	Loggerhead Shrike
Greater Roadrunner	House Finch	Gambel's Quail
Horned Lark	Tree Swallow	Ash-throated Flycatcher
Tree Swallow	American Kestrel	LeConte's Thrasher
Anna's Hummingbird		Brewer's Sparrow
Cliff Swallow		Ladder-backed Woodpecker
Northern Rough-winged Swallow		Bewick's Wren/Verdin/ Lesser Nighthawk[3]

[1] Bird and bat fatalities and injuries found during fatality searches are called detections.
[2] Seven species observed on heliostat grids; all are listed here.
[3] Species are listed in descending order of abundance and in alphabetical order where equal numbers of individuals were observed.

3.2 Raptor and Large Bird Use Monitoring

This section discusses the results of surveys for use of the site and surrounding areas by raptors and other large birds, including a summary of species composition, abundance, and habitat use, as observed from points around the edges of and outside the facility. In addition, this section provides information on the number of individuals of these species observed perched vs. those in flight, as well as the heights at which flying birds were recorded. A total of 96 hours of field observation time was spent conducting raptor/large bird surveys during the 2014 summer season.

3.2.1 General Species Composition, Abundance, and Habitat Use

Three 4-hour surveys for raptors and other large birds were conducted from each of eight points as shown on Figure 3. During these surveys, three raptor species and three other large bird species were observed and identifiable. Table 6 summarizes the total number of observations of each of these species during all surveys combined and indicates the locations in which the birds were observed. Due to the long duration of each survey and the mobility of these birds, it was not always possible to track individuals throughout a survey to avoid counting the same individuals multiple times. Consequently, results of large bird use monitoring surveys are reported in terms of observation rather than individuals.

Table 6. Raptor/Large Bird Point Count Results Summary (Number of Observations).

Common Name	Scientific Name	Ivanpah Facilities	Desert	Mountains	Total
Common Raven	*Corvus corax*	8	7	0	15
American Kestrel	*Falco sparverius*	4	2	0	6
Red-tailed Hawk	*Buteo jamaicensis*	1	4	0	5
Ring-billed Gull	*Larus delawarensis*	0	3	0	3
Unknown Falcon		0	2	0	2
Unknown Gull		2	0	0	2
Unknown Raptor		1	1	0	2
Golden Eagle	*Aquila chrysaetos*	0	0	1	1
California Gull	*Larus californicus*	1	0	0	1
Total		**17**	**19**	**1**	**37**

Common ravens comprised 40.5% of all large bird observations. The preponderance of raven observations resulted less from the abundance of ravens on the site (observed only as singles or pairs) than from the persistent nature (frequently present) and widespread occurrence of the species. The number of raven observations was similar between the Ivanpah facilities and the nearby desert, but none were observed toward the mountains. American kestrels were more commonly observed in or over the heliostat arrays than in the desert. None were observed in the mountains; although this falcon's small size makes very distant observations difficult. In addition to observations during raptor surveys, there were also 10 incidental observations of American kestrels using the heliostat arrays. Most other raptors/large birds were most commonly observed over the desert, with few or no observations within the Ivanpah facilities. The only golden eagle observed was in the mountains. None were observed at the Ivanpah facilities, either during formal surveys or incidentally, in summer 2014. There were relatively few incidental observations of other raptors or large birds at, or over, the Ivanpah facilities during the 2014 summer season. These involved occasional red-tailed hawk (*Buteo jamaicensis*), common raven, and American kestrel observations, as well as single observations of a peregrine falcon (*Falco peregrinus*) and northern harrier (*Circus cyaneus*).

As shown by Table 7, the frequency of occurrence of large birds, in terms of the number/survey hour, was relatively low. An average of approximately 0.4 birds/ hour was recorded during the 96 hours of raptor/large bird surveys.

Table 7. Raptor/Large Bird Point Count Results Summary (Number of Observations/Survey Hour).

Common Name	Ivanpah Facilities	Desert	Mountain	Total
Common Raven	0.08	0.07	0.00	0.16
American Kestrel	0.04	0.02	0.00	0.06
Red-tailed Hawk	0.01	0.04	0.00	0.05
Ring-billed Gull	0.00	0.03	0.00	0.03
Unknown Falcon	0.00	0.02	0.00	0.02
Unknown Gull	0.02	0.00	0.00	0.02
Unknown Raptor	0.01	0.01	0.00	0.02
Golden Eagle	0.00	0.00	0.01	0.01
California Gull	0.01	0.00	0.00	0.01
Total	**0.18**	**0.20**	**0.01**	**0.39**

Most of the raptors/large birds that were observed perched were common ravens and red-tailed hawks, which were observed perched primarily on electrical transmission towers both on and off-site. American kestrels were seen perched on heliostats incidentally (i.e., outside of raptor/large bird surveys) on multiple occasions, although during formal surveys these birds were more frequently observed in flight. At no time during the 2014 summer season were raptors or other large birds observed perched on the Ivanpah power towers during formal surveys.

The majority of observations of raptors and other large birds involved individuals seen in flight. Per Section 2.3 of the Plan, the height of flight above ground level (agl) was recorded in one of the following categories:

- 0 = < 10 m agl, (within the heliostat collision-risk zone)
- 1 = 10–100 m agl, (between the height of the heliostat collision-risk zone and the height of the elevated solar flux risk zone in areas closer to the power towers)
- 2 = 100–200 m agl (within the elevated solar flux risk zone (primary boiler area at 120–140 m agl))
- 3 = > 200 m agl (above the elevated solar flux risk zone)

Table 8 provides the number of observations of each species that were perched or that were flying in each height category; this information is provided separately for birds seen over Ivanpah facilities and over other habitats such as desert and mountains.

Within the Ivanpah facility, the majority of birds were observed perched (mostly ravens) or flying above 200 m (gulls and shorebirds). In surrounding areas, the highest numbers were observed flying between 10 and 100 m above ground level (mostly ravens and nighthawks).

Table 8. Flight Heights of Raptors and Other Large Birds Over Ivanpah Facilities and Other Habitats/Areas (Data are the Number of Observations at Each Flight Height).

	Above Ivanpah Facilities					Above Other Habitats/Areas				
Species	**Perched**	**0**	**1**	**2**	**3**	**Perched**	**0**	**1**	**2**	**3**
Common Raven	5	1	2	0	0	2	0	4	1	0
American Kestrel	2	1	1	0	0	0	2	0	0	0
Red-tailed Hawk	1	0	0	0	0	4	0	0	0	0
Ring-billed Gull	0	0	0	0	0	0	0	0	3	0
Unknown Falcon	0	0	0	0	0	1	0	1	0	0
Unknown Gull	0	0	0	0	2	0	0	0	0	0
Unknown Raptor	0	0	0	1	0	1	0	0	0	0
Golden Eagle	0	0	0	0	0	0	0	0	1	0
California Gull	0	0	0	0	1	0	0	0	0	0
Total	**8**	**2**	**3**	**1**	**3**	**8**	**2**	**5**	**5**	**0**

3.2.2 Raptor and Large Bird Distribution

Table 9 provides the number of observations of each raptor and large bird species from each of the eight survey points (Figures 8-15).

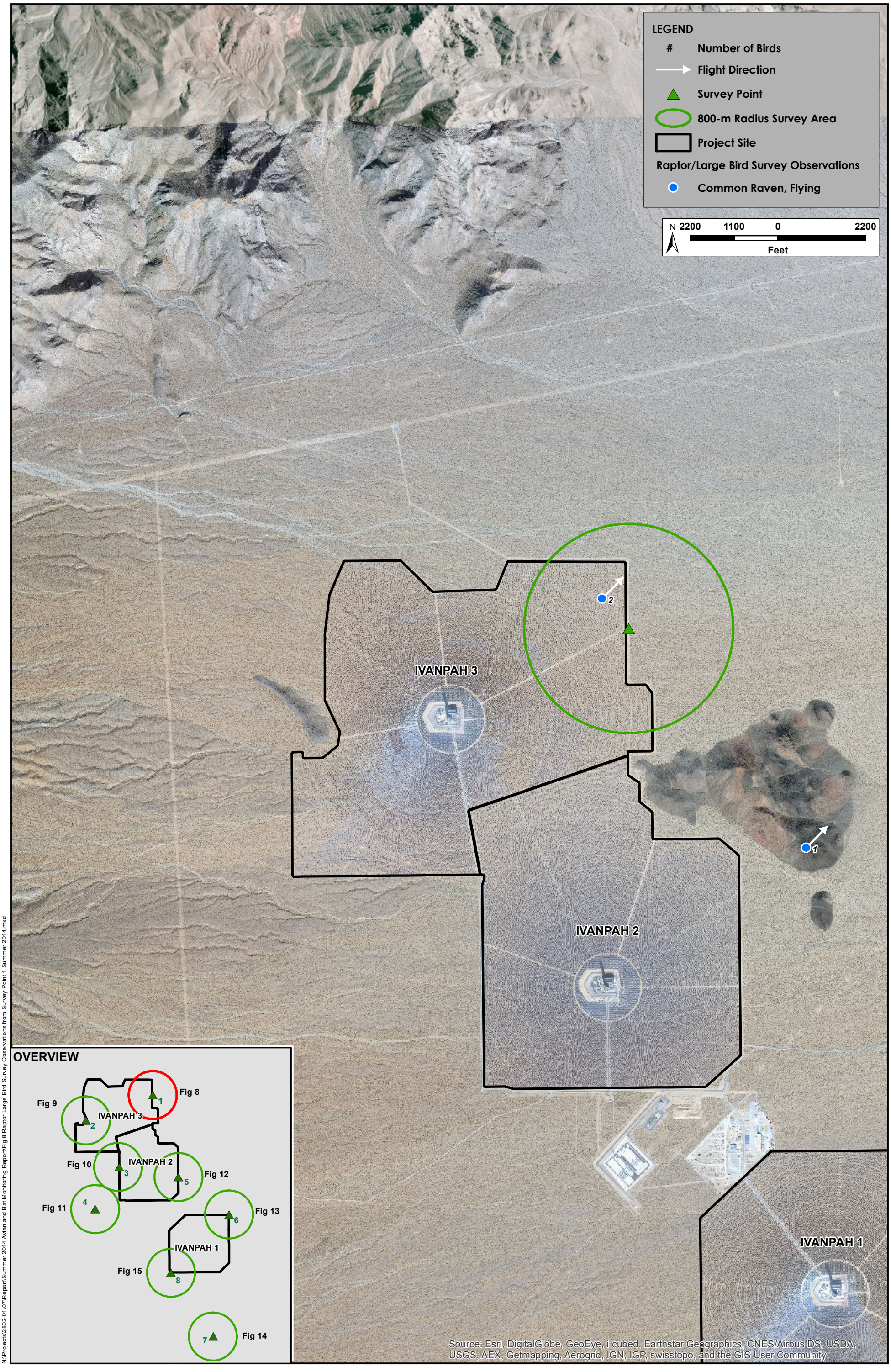
Table 9. Raptor/Large Bird Point Count Results By Survey Point.

	Survey Point							
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Common Raven	3	1	5	0	0	4	2	0
American Kestrel	0	2	1	1	0	1	1	0
Red-tailed Hawk	0	0	0	0	0	5	0	0
Ring-billed Gull	0	0	0	0	3	0	0	0
Unknown Falcon	0	0	0	0	0	1	0	1
Unknown Gull	0	0	0	0	0	0	0	2
Unknown Raptor	0	0	0	0	0	1	0	1
Golden Eagle	0	1	0	0	0	0	0	0
California Gull	0	0	0	0	1	0	0	0
Total	**3**	**4**	**6**	**1**	**4**	**12**	**3**	**4**

Points 1 and 2, 3 and 5, and 6 and 8 represent paired points on the eastern and western sides of Units 3, 2, and 1, respectively. At all three units, overall abundance was higher on the eastern points than on the western. In Unit 1, this difference appears to have resulted from higher common raven and red-tailed hawk abundance near the Primm Valley Golf Course and perched on power poles along Coliseum Road. Higher raven abundance occurred on the eastern side of Unit 3. Ravens move between the Ivanpah site and areas to the

east in Primm with anthropogenic food sources, but there is relatively low abundance of ravens in areas toward the mountains west of the Project site.

Figures 8 through 15 depict the results of raptor surveys in terms of the locations of birds observed; number of individuals; whether the birds were flying or perched; and flight direction (for flying birds). All observations for the entire season are shown on a single figure for each of the eight survey points to document locations and concentrations, if any, of activity of raptors and other large birds.



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 8 Raptor Large Bird Survey Observations from Survey Point 1 Summer 2014.mxd

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Figure 8: Raptor/Large Bird Survey Observations from Survey Point 1, Summer 2014

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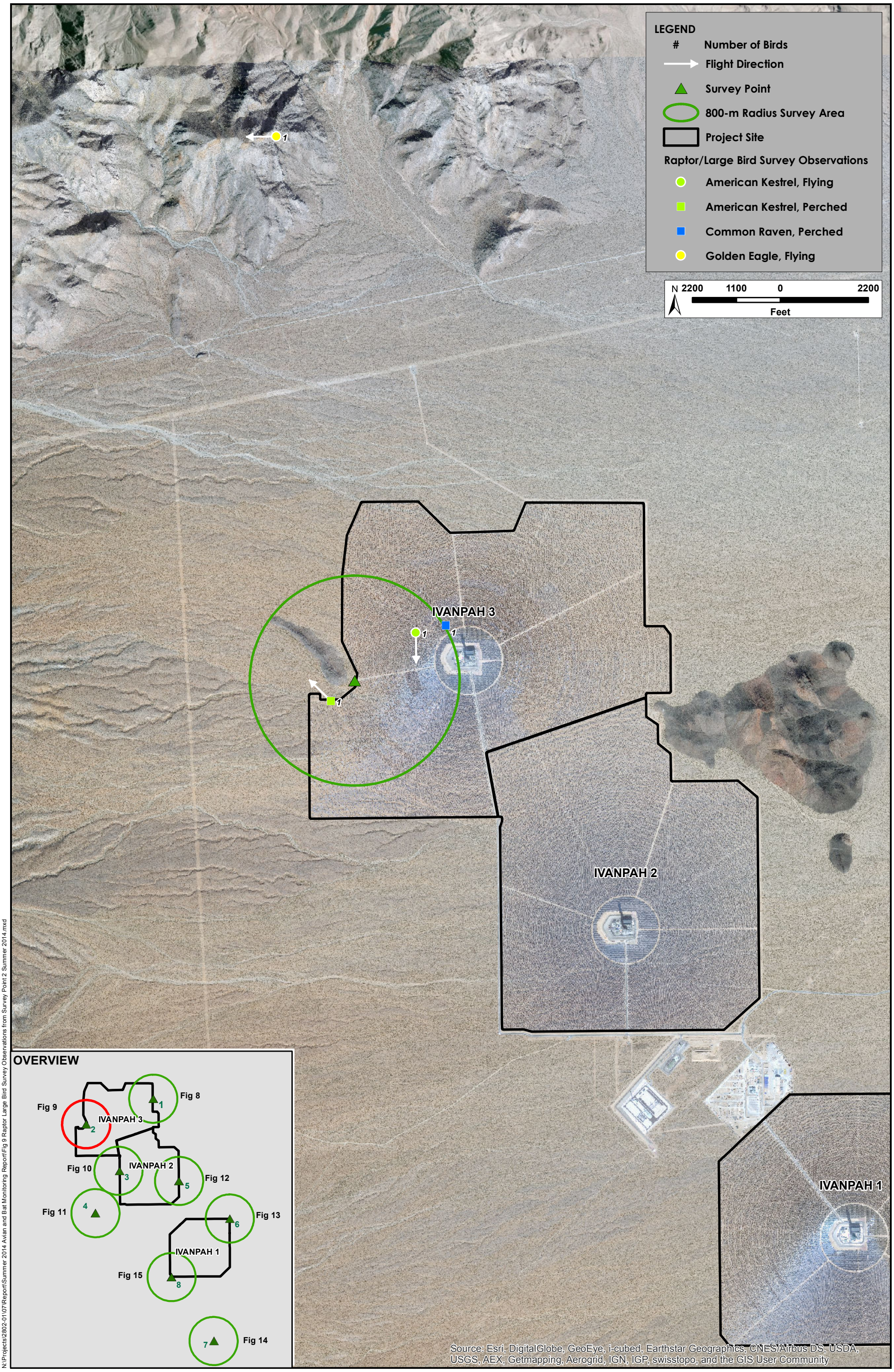
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 9 Raptor Large Bird Survey Observations from Survey Point 2 Summer 2014.mxd

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Figure 9: Raptor/Large Bird Survey Observations from Survey Point 2, Summer 2014

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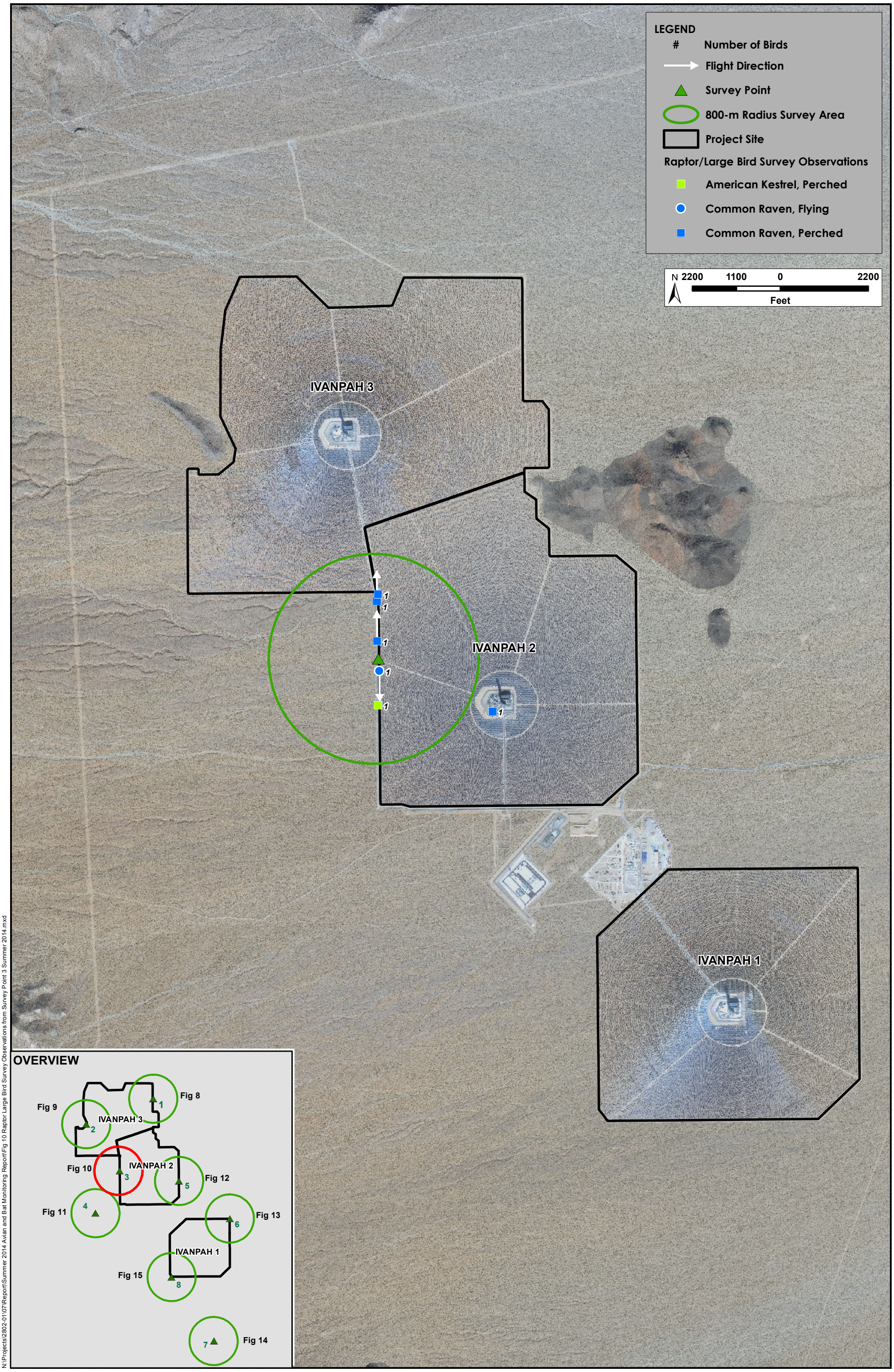
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 10 Raptor Large Bird Survey Observations from Survey Point 3 Summer 2014.mxd

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Figure 10: Raptor/Large Bird Survey Observations from Survey Point 3, Summer 2014

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December 2014

LEGEND

Number of Birds

Flight Direction

Survey Point

800-m Radius Survey Area

Project Site

Raptor/Large Bird Survey Observations

American Kestrel, Flying

N 2200 1100 0 2200

Feet

IVANPAH 3

IVANPAH 2

IVANPAH 1

1

OVERVIEW

Fig 8

Fig 9

IVANPAH 3

Fig 10

IVANPAH 2

Fig 12

Fig 11

Fig 13

IVANPAH 1

Fig 15

Fig 14

N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 11 Raptor Large Bird Survey Observations from Survey Point 4 Summer 2014.mxd

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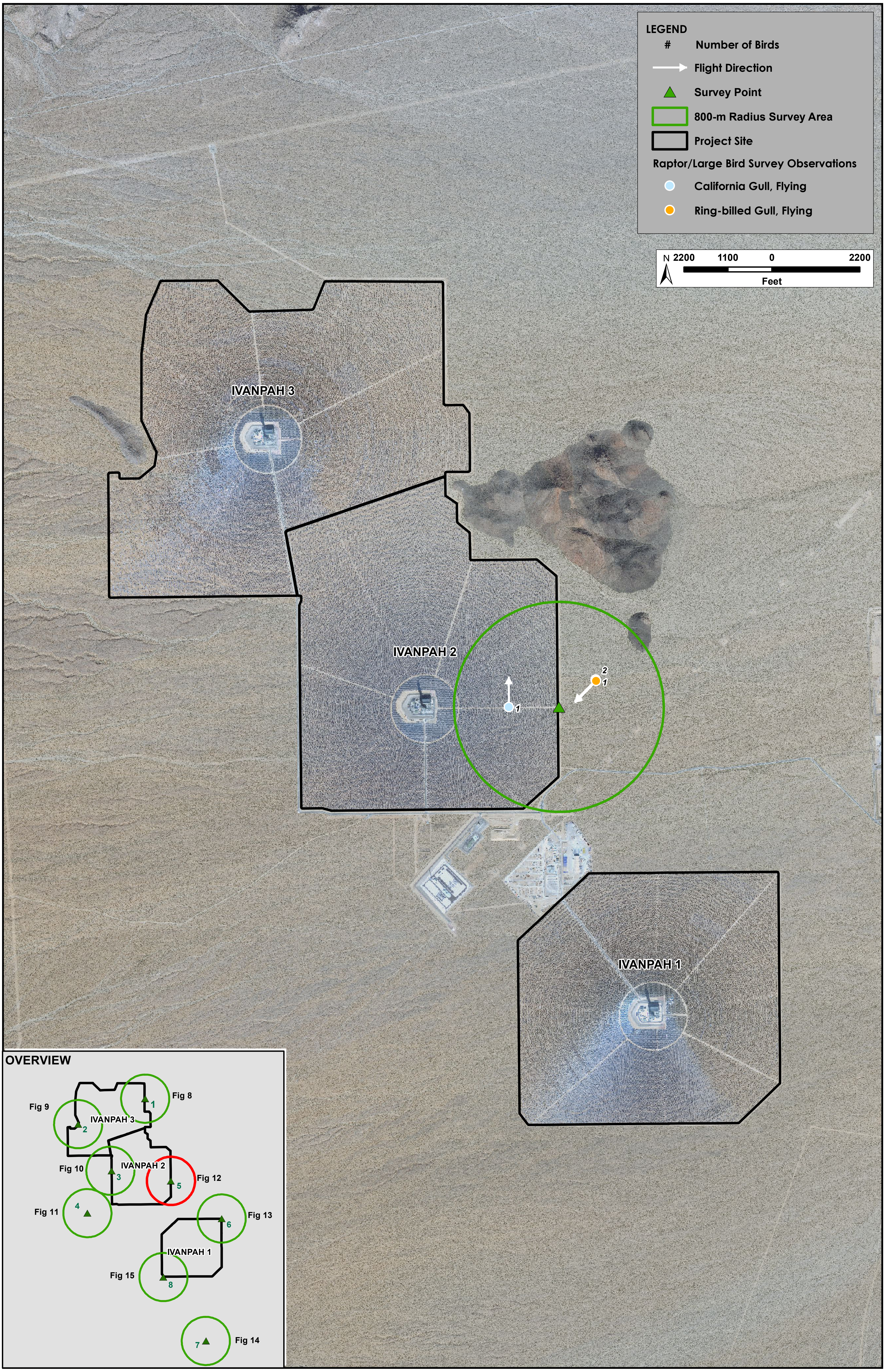
Figure 11: Raptor/Large Bird Survey Observations from Survey Point 4, Summer 2014

Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)

December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 12 Raptor Large Bird Survey Observations from Survey Point 5 Summer 2014.mxd

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Figure 12: Raptor/Large Bird Survey Observations from Survey Point 5, Summer 2014
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

LEGEND

Number of Birds

Flight Direction

Survey Point

800-m Radius Survey Area

Project Site

Raptor/Large Bird Survey Observations

American Kestrel, Flying

Common Raven, Flying

Common Raven, Perched

Red-tailed Hawk, Perched

Unknown Falcon/Bird, Perched

Unknown Raptor/Bird, Perched

N 2200 1100 0 2200

Feet

IVANPAH 3

IVANPAH 2

IVANPAH 1

1 1 1 2 1 1 1 2 1 1 1

OVERVIEW

Fig 8

Fig 9

Fig 10

Fig 11

Fig 12

Fig 13

Fig 14

Fig 15

1 2 3 4 5 6 7 8

N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 13 Raptor Large Bird Survey Observations from Survey Point 6 Summer 2014.mxd

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Figure 13: Raptor/Large Bird Survey Observations from Survey Point 6, Summer 2014

Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)

December 2014

IVANPAH 2

IVANPAH 1

LEGEND

Number of Birds

Flight Direction

Survey Point

800-m Radius Survey Area

Project Site

Raptor/Large Bird Survey Observations

American Kestrel, Flying

Common Raven, Flying

N 2200 1100 0 2200

Feet

2

1

OVERVIEW

Fig 8

Fig 9

IVANPAH 3

Fig 10

IVANPAH 2

Fig 12

Fig 11

Fig 13

IVANPAH 1

Fig 15

Fig 14

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 14 Raptor Large Bird Survey Observations from Survey Point 7 Summer 2014.mxd

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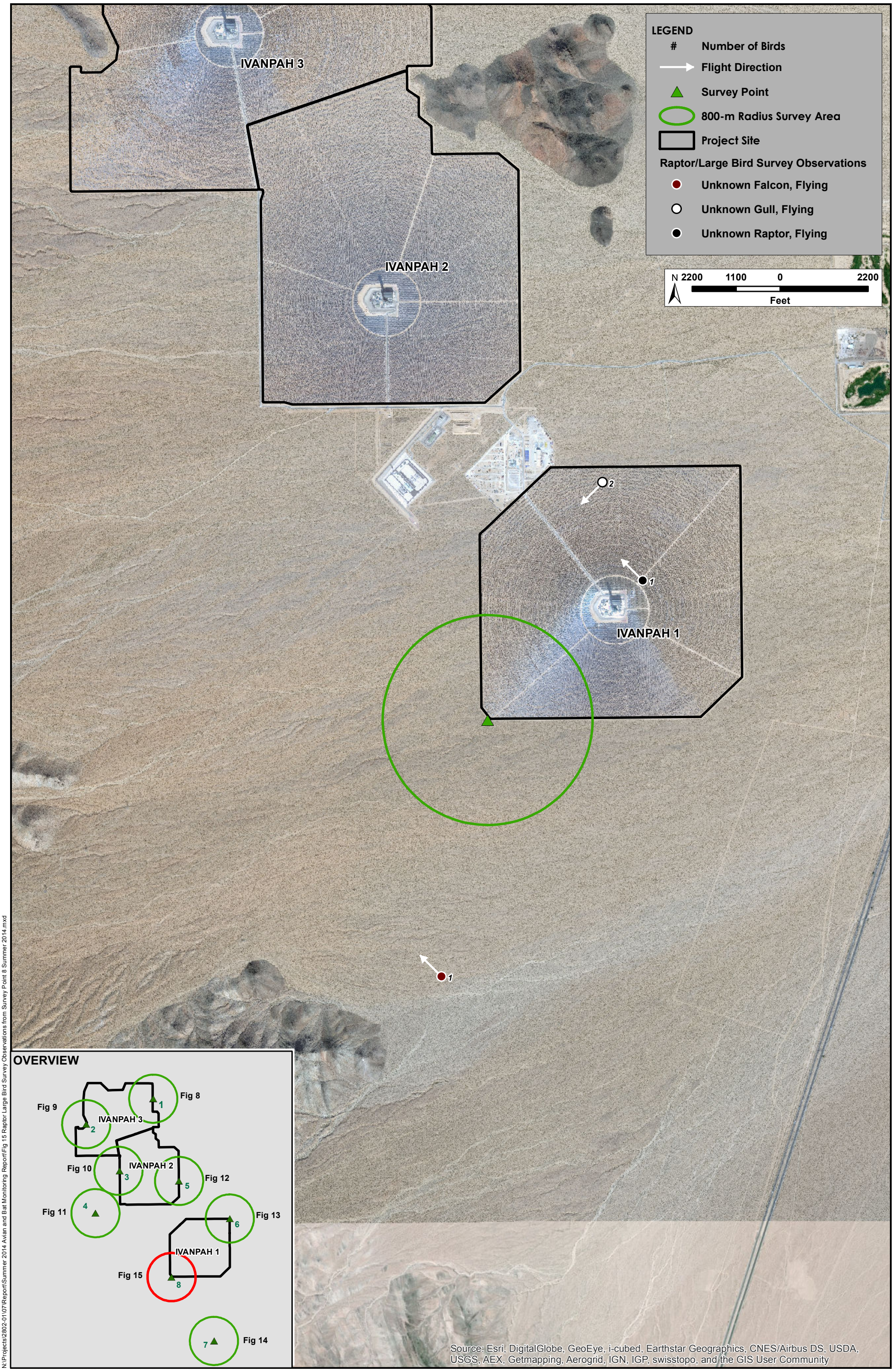
Figure 14: Raptor/Large Bird Survey Observations from Survey Point 7, Summer 2014

Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)

December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 15 Raptor Large Bird Survey Observations from Survey Point 8 Summer 2014.mxd

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Figure 15: Raptor/Large Bird Survey Observations from Survey Point 8, Summer 2014

Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)

December 2014

Section 4.0 Monitoring Results

4.1 Avian and Bat Detections

The following section describes the basic descriptions and distributions of the detection data. The summary provides the numbers and species list of these detections.

4.1.1 Summary of Avian and Bat Detections

During the period 23 May – 17 August 2014, a total of one live bat (possibly sick or temporarily unable to fly), 11 bat fatalities, and 115 avian fatalities (including three injured birds that died shortly after detection), were detected. The live bat was given food and water and kept in a cool, dry place until evening, when it was released. In total, summer detections included 36 avian species and four bat species. The total number of avian and bat detections is listed by species in Table 10 below. Appendix A includes additional data on these birds and bats. Figures 16, 17, 18 and 19 depict the locations of all bird and bat detections in Units 1, 2, and 3, and outside the units, respectively.

Table 10. Number of Individual Bird and Bat Detections, by Species, 23 May – 17 August 2014.

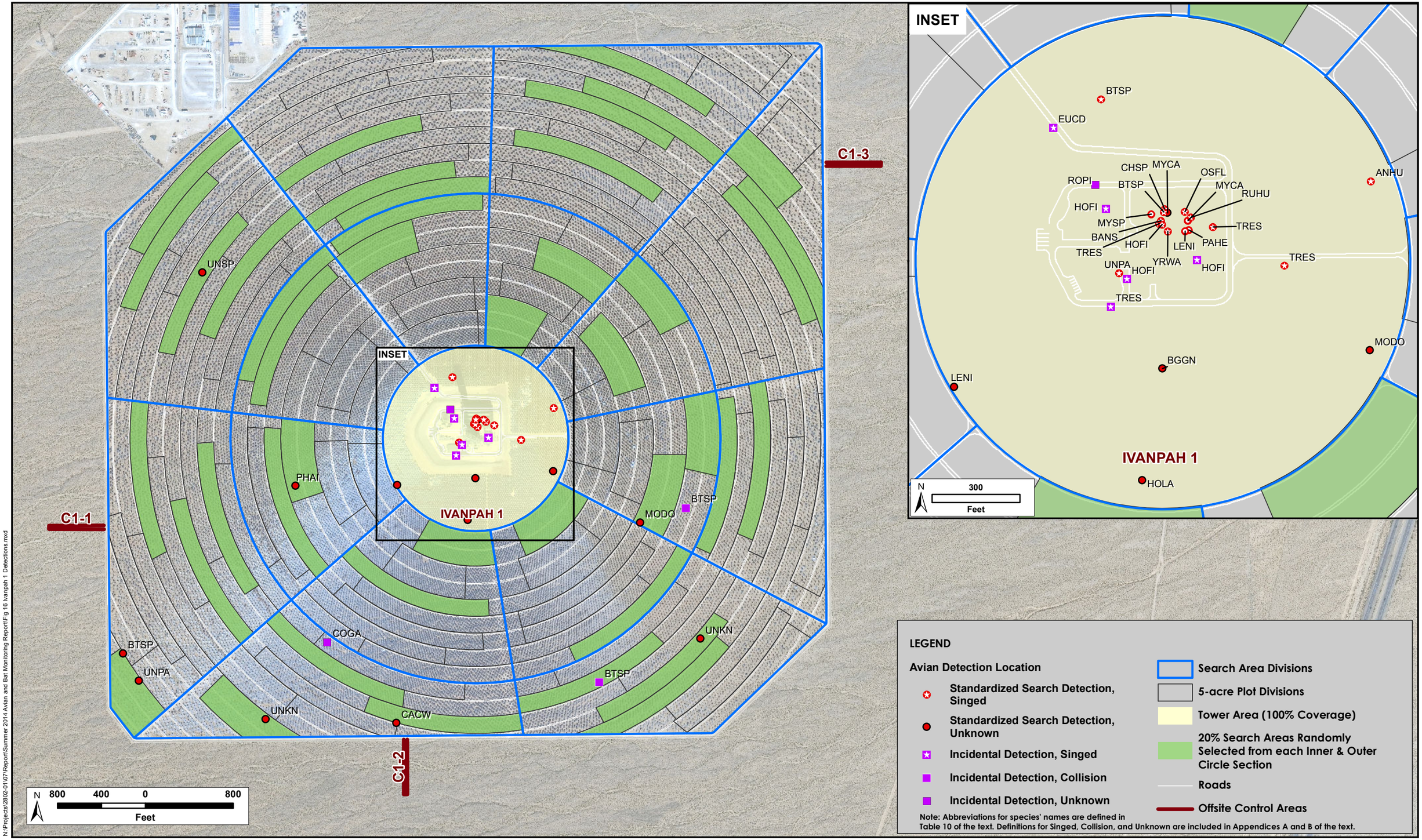
Common Name*	Scientific Name	Species Code**	# of Detections
Mourning Dove[2]	*Zenaida macroura*	MODO	15
Unknown passerine[1]		UNPA	12
Black-throated Sparrow[1]	*Amphispiza bilineata*	BTSP	11
House Finch[1]	*Haemorhous mexicanus*	HOFI	6
Lesser Nighthawk[1]	*Chordeiles acutipennis*	LENI	6
Greater Roadrunner[2]	*Geococcyx californianus*	GRRO	5
Horned Lark[1]	*Eremophila alpestris*	HOLA	5
Tree Swallow[1]	*Tachycineta bicolor*	TRES	5
Anna's Hummingbird[1]	*Calypte anna*	ANHU	4
Cliff Swallow[1]	*Petrochelidon pyrrhonota*	CLSW	4
Northern Rough-winged Swallow[1]	*Stelgidopteryx serripennis*	NRWS	3
Unknown[4]		UNKN	3
Hermit Warbler[1]	*Setophaga occidentalis*	HEWA	2
Townsend's Warbler[1]	*Setophaga townsendi*	TOWA	2
Verdin[1]	*Auriparus flaviceps*	VERD	2
Yellow Warbler[1]	*Setophaga petechia*	YEWA	2
Yellow-rumped Warbler[1]	*Setophaga coronata*	YRWA	2
Unknown Hummingbird[1]		UNHU	2

Common Name*	Scientific Name	Species Code**	# of Detections
American Kestrel[2,3]	*Falco sparverius*	AMKE	1
Bank Swallow[1]	*Riparia riparia*	BANS	1
Bewick's Wren[1]	*Thryomanes bewickii*	BEWR	1
Blue-gray Gnatcatcher[1]	*Polioptila caerula*	BGGN	1
Brown-headed cowbird[1]	*Molothrus ater*	BHCO	1
Cactus Wren[1]	*Campylorhynchus brunneicapillus*	CACW	1
Calliope Hummingbird[1]	*Selasphorus calliope*	CAHU	1
Chipping Sparrow[1]	*Spizella passerina*	CHSP	1
Common Gallinule[2]	*Gallinula galeata*	COGA	1
Costa's Hummingbird[1]	*Calypte costae*	COHU	1
Eurasian Collared-Dove[2]	*Streptopelia decaocto*	EUCD	1
Lapland Longspur[1]	*Calcarius lapponicus*	LALO	1
Lazuli Bunting[1]	*Passerina amoena*	LAZB	1
Loggerhead Shrike[1]	*Lanius ludovicianus*	LOSH	1
Olive-Sided Flycatcher[1]	*Contopus cooperi*	OSFL	1
Phainopepla[1]	*Phainopepla nitens*	PHAI	1
Pine Siskin[1]	*Spinus pinus*	PISI	1
Rock Pigeon[2]	*Columba livia*	ROPI	1
Rufous Hummingbird[1]	*Selasphorus rufus*	RUHU	1
Scott's Oriole[1]	*Icterus parisorum*	SCOR	1
Yellow-headed Blackbird[1]	*Xanthocephalus xanthocephalus*	YHBL	1
Unknown Passerine/Swift[1]		UNPS	1
Unknown Sparrow[1]		UNSP	1
Unknown Swallow[1]		UNSW	1
Bats			
California Myotis	*Myotis californicus*	MYCA	5
Canyon Bat	*Parastrellus hesperus*	PAHE	4†
Western Small-footed Bat	*Myotis ciliolabrum*	MYCI	1
Mexican Free-tailed Bat	*Tadarida brasiliensis*	TABR	1
Unknown Myotis species	*Myotis* sp.	MYSP	1

* For each avian species, the size of the detection, as well as a notation if it is a raptor, is provided to indicate how each species was considered in the fatality estimates (i.e., as a small bird, large bird, and/or raptor), as follows: [1] Small bird; [2] Large bird; [3] Raptor; [4] For the purpose of fatality estimation, each detection of unknown species group is given a size based on an assessment of feather size where possible.

** Species code refers to the four-letter code by which the species are referred on Figures 16 - 19.

† Includes one individual found ill but released alive the same day.



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 16 Ivanpah 1 Detections.mxd

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Figure 16: Ivanpah 1 Detections
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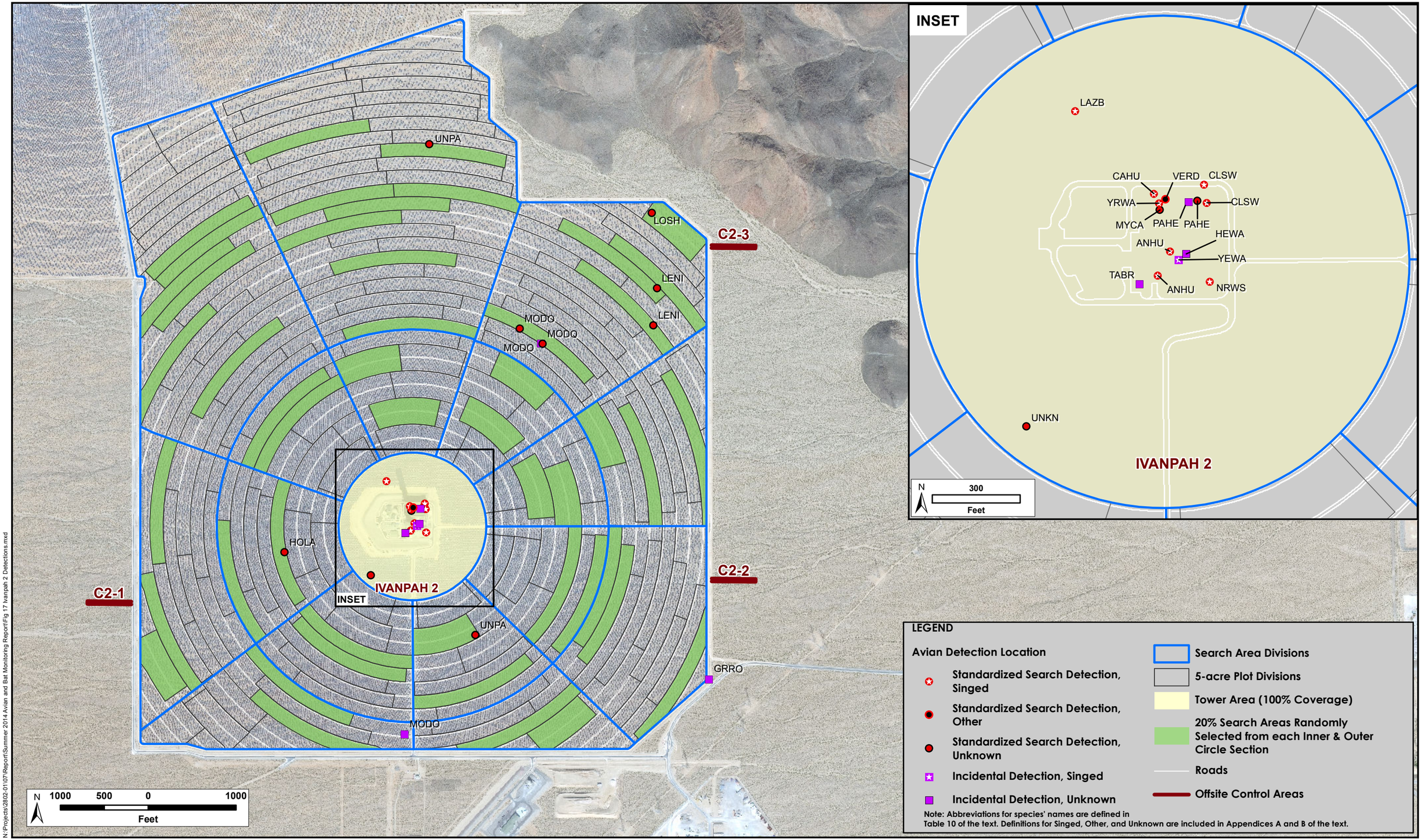
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 17 Ivanpah 2 Detections.mxd

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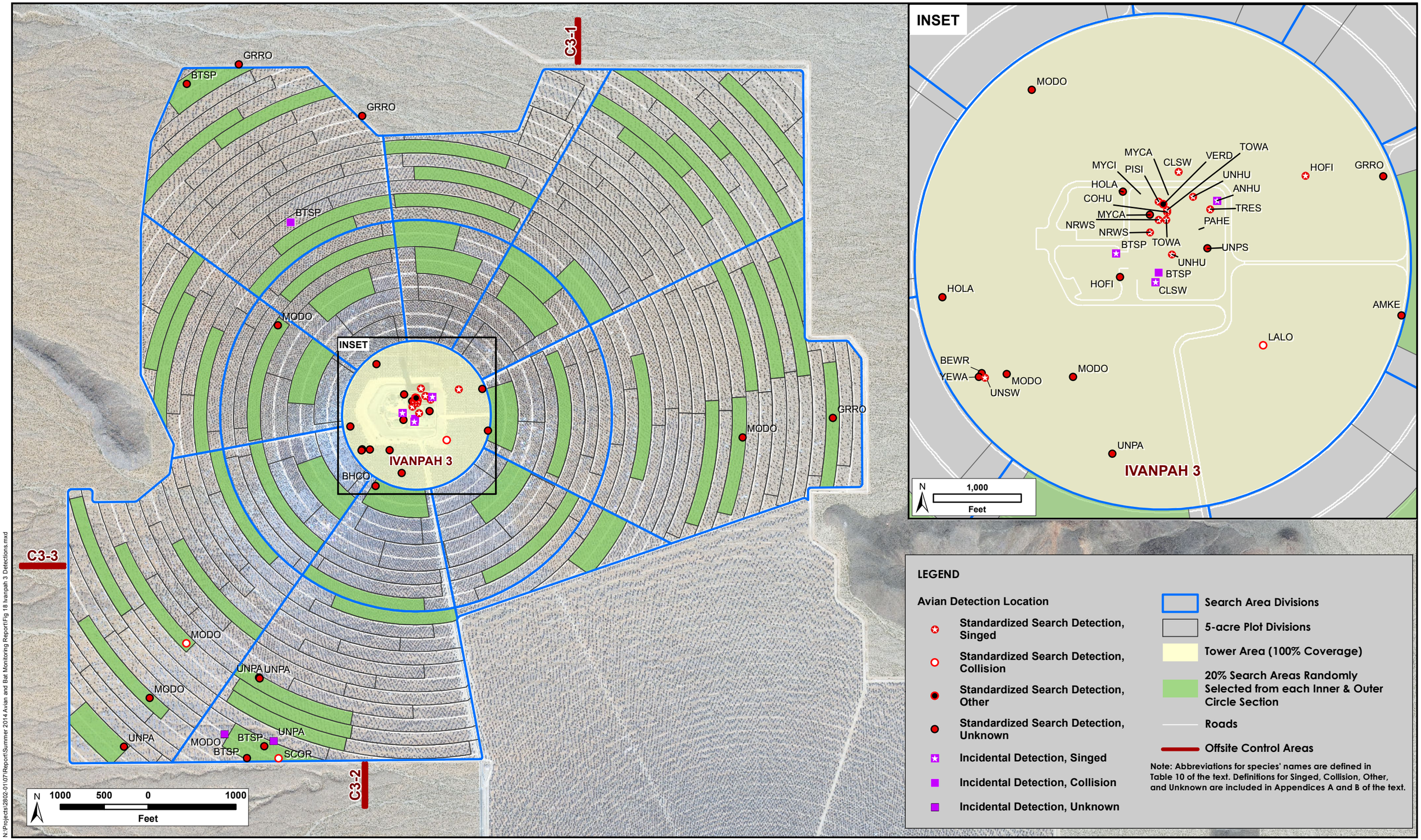
Figure 17: Ivanpah 2 Detections
Ivanpah Spring 2014 Avian and Bat Monitoring Report (2802-07)
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 18 Ivanpah 3 Detections.mxd

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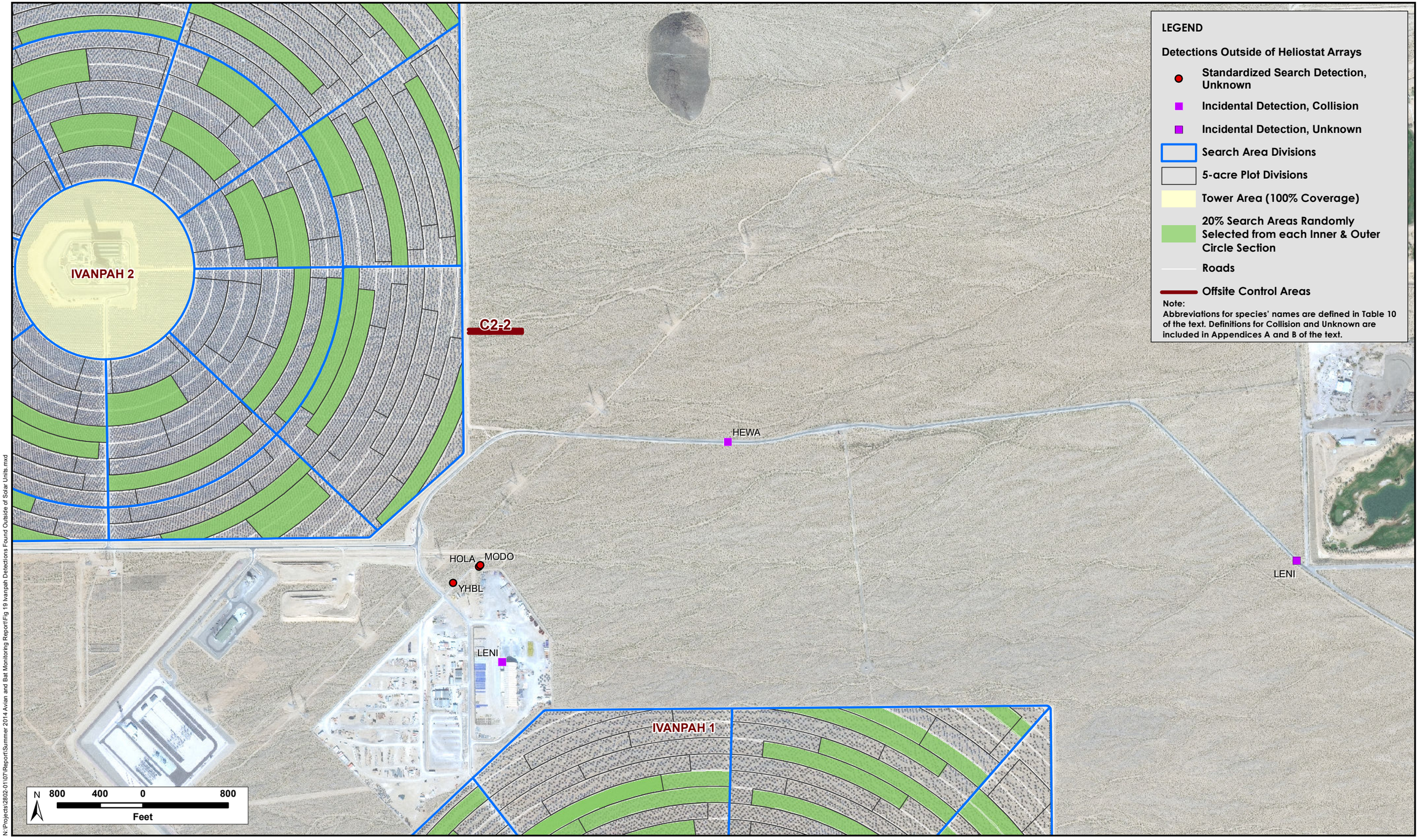
Figure 18: Ivanpah 3 Detections
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014



N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 19 Ivanpah Detections Found Outside of Solar Units.mxd

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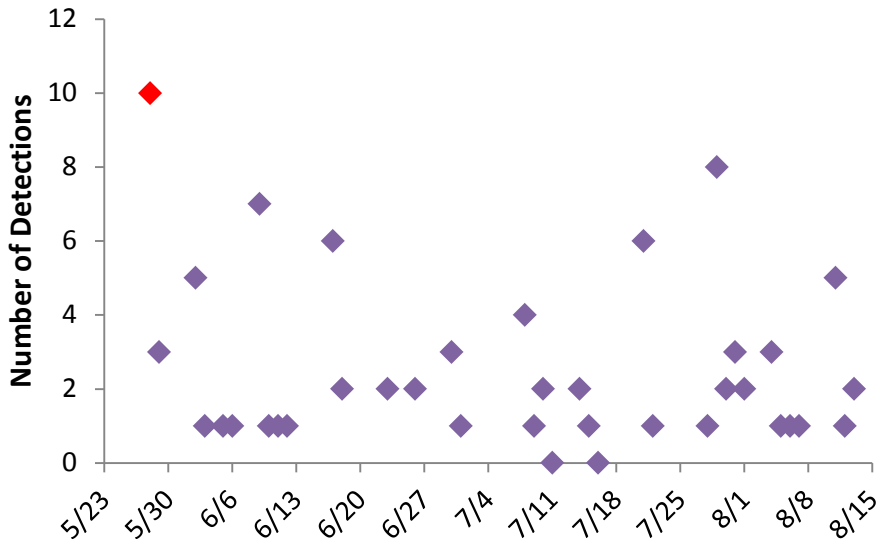
Figure 19: Ivanpah Detections Found Outside of Solar Units
Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)
December 2014

There was no obvious temporal clumping of detections recorded during the summer season, and only one survey day (28 May) resulted in as many as 10 detections (Figure 20). The majority of detections on this day were in the tower area (power block and inner HD heliostats) of Unit 3, and these detections were distributed among singed, collision, and unknown detections (rather than just one mortality cause). This "clump" of detections was likely related to late northbound migratory activity in the region. The Cornell Lab of Ornithology's "BirdCast" website[1] indicated that migration activity was light to moderate in the desert southwest for the week of 23 to 30 May. BirdCast ceased analyzing northbound ("spring") migration activity on 30 May and did not publish predictions or analyses of migration activity over the summer season.

Figure 20. Number of Detections on Each Survey Date, 23 May – 17 August 2014.



*The red point denotes a survey where 10 detections were found.
Excludes bats and detections for which time since death is >1 month or unknown.

4.1.2 Injured Birds

Three injured birds were detected during this reporting period (Table 11). The injured Eurasian collared-dove, a non-native species, was euthanized per instructions from U. S. Fish and Wildlife Office of Law Enforcement (OLE) Special Agent Michael Clark. The other two injured birds eventually succumbed to their injuries. Of the two native injured birds, one with collision injuries died on-site soon after capture, and the other that was singed died after being transported to the Big Bear Zoo rehabilitation center. All three of these birds are included in this report as fatalities.

[1] http://birdcast.info/forecasts

Table 11. Avian Injuries Detected 23 May – 17 August 2014.

Date	Species	Age	Sex	Cause of Injury	Burn Grade	Fate
6/12/14	HOFI	J	U	Singed	2, 3	Died at rehab
6/18/14	EUCD	A	U	Singed	2, 3	Euthanized per OLE instructions
7/31/14	BTSP	A	U	Collision	N/A	Died at Ivanpah

4.1.3 Summary of Bat Detections

Twelve bats representing four species were detected during this reporting period (Table 12). Of these detections, one live bat was found. The bat had no obvious external injuries, but would not fly away, so it was captured, given food and water, and kept in a cool, dark box until evening. Because the bat had recovered by evening, it was released. All bat detections were within or immediately adjacent to the ACC buildings.

Table 12. Summary of Bat Detections, 23 May – 17 August 2014 .

Species	Scientific Name	Date	Location
California Myotis	*Myotis californicus*	6/2/2014	Unit 2 ACC
California Myotis	*Myotis californicus*	6/30/2014	Unit 1 ACC
California Myotis	*Myotis californicus*	7/8/2014	Unit 3 ACC
California Myotis	*Myotis californicus*	7/8/2014	Unit 3 ACC
California Myotis	*Myotis californicus*	8/11/2014	Unit 1 ACC
Canyon Bat	*Parastrellus hesperus*	7/29/2014	Unit 3 ACC
Canyon Bat*	*Parastrellus hesperus*	7/29/2014	Unit 2 Power Block Road
Canyon Bat	*Parastrellus hesperus*	8/4/2014	Unit 2 ACC
Canyon Bat	*Parastrellus hesperus*	8/11/2014	Unit 1 ACC
Western Small-footed Bat	*Myotis ciliolabrum*	7/8/2014	Unit 3 ACC
Mexican Free-tailed Bat	*Tadarida brasiliensis*	8/1/2014	Unit 2 Power Block Building
Unknown Myotis species	*Myotis sp.*	8/11/2014	Unit 1 ACC

*Found alive, released same day.

4.1.4 Incidental Detections

A total of 27 incidental avian detections and two incidental bat detections (including the live bat) were recorded during this quarter. Twenty-four of these avian detections and both bat detections were within the solar units (Figures 16, 17, and 18). The other three incidental avian detections (one collision-related and two of unknown cause) were in areas of the Project site outside of the solar units, including the Common Logistic Area (CLA) and along Coliseum Road (Figure 19).

4.1.5 Fatalities Found During Standardized Searches

During the course of 2014 summer season standardized searches, searchers found 88 bird detections and 10 bat detections (Figures 16, 17, and 18).

4.2 Locations of Avian Detections

As indicated in Table 13, 66 detections (57.4%) were within 260 m of the tower, an area that was searched with 100% coverage. Forty detections (34.8%) were detected over the much larger area composed of the inner and outer heliostats. Otherwise, six detections were along the fence lines (5.2%), and three were on Project lands outside the standardized search areas (2.6%) (Figure 19). No detections were noted within the survey areas associated with the Unit 3 Collector Line or the offsite control transects. Of the 109 avian detections within the solar units (i.e., excluding the CLA fence and other Project lands), 35 (32.1%) were detected in Unit 1, 23 (21.1%) in Unit 2, and 51 (46.8 %) in Unit 3. The three units operated with similar numbers of days in flux during the summer period. Unit 1 operated with 71 days in flux, while Units 2 and 3 operated with 66 days in flux.

Table 13. Locations of Bird Detections, 23 May – 17 August 2014.

Location	Injuries	Fatalities
Power Block	0	44*
Inner HD Heliostats	0	22
Inner Segment Heliostats	0	6
Outer Segment Heliostats	0	34**
Unit Perimeter Fences	0	3
CLA Fence	0	3
Unit 3 Collector Line	0	0
Offsite Control Transects	0	0
Other Project Lands	0	3
Total	0	115

* 24 of the 44 power block detections were in the ACC buildings
** 24 of the fatalities found in the outer segments were found by scent detection dogs

4.3 Cause of Injury or Fatality

The following section describes the number of detections with evidence of singeing or collision effects; the number from "other Project causes", which in summer 2014 included two avian detections in the ACC buildings without signs of singeing or collision effects; the number for which cause of injury or fatality is unknown; and the spatial distributions of detections with these causes relative to the towers. Methods for identifying the cause of injury or fatality were provided in Section 2.2.1.3. Table 14 indicates the total number of detections with evidence of singeing or collision effects, from other Project causes, or for which cause of injury or fatality is unknown. Detections with an "unknown" cause of injury or death refer to those for which

there was no evidence of singeing (e.g., charring, curling, or melting of feathers) or collision (e.g., obvious physical trauma or detection adjacent to a heliostat with a bird-strike imprint and/or feathers on the heliostat), each as confirmed through microscopic examination.

Table 14. Number of Avian Detections from Singeing, Collision, Other Project Causes, and Unknown Causes, 23 May – 17 August 2014.

Cause	Number of Detections
Singeing	42
Collision	10
Other	2*
Unknown	61
Total	115

* Includes two detections in ACC buildings without evidence of singeing or collision effects.

4.3.1 Solar Flux Effects

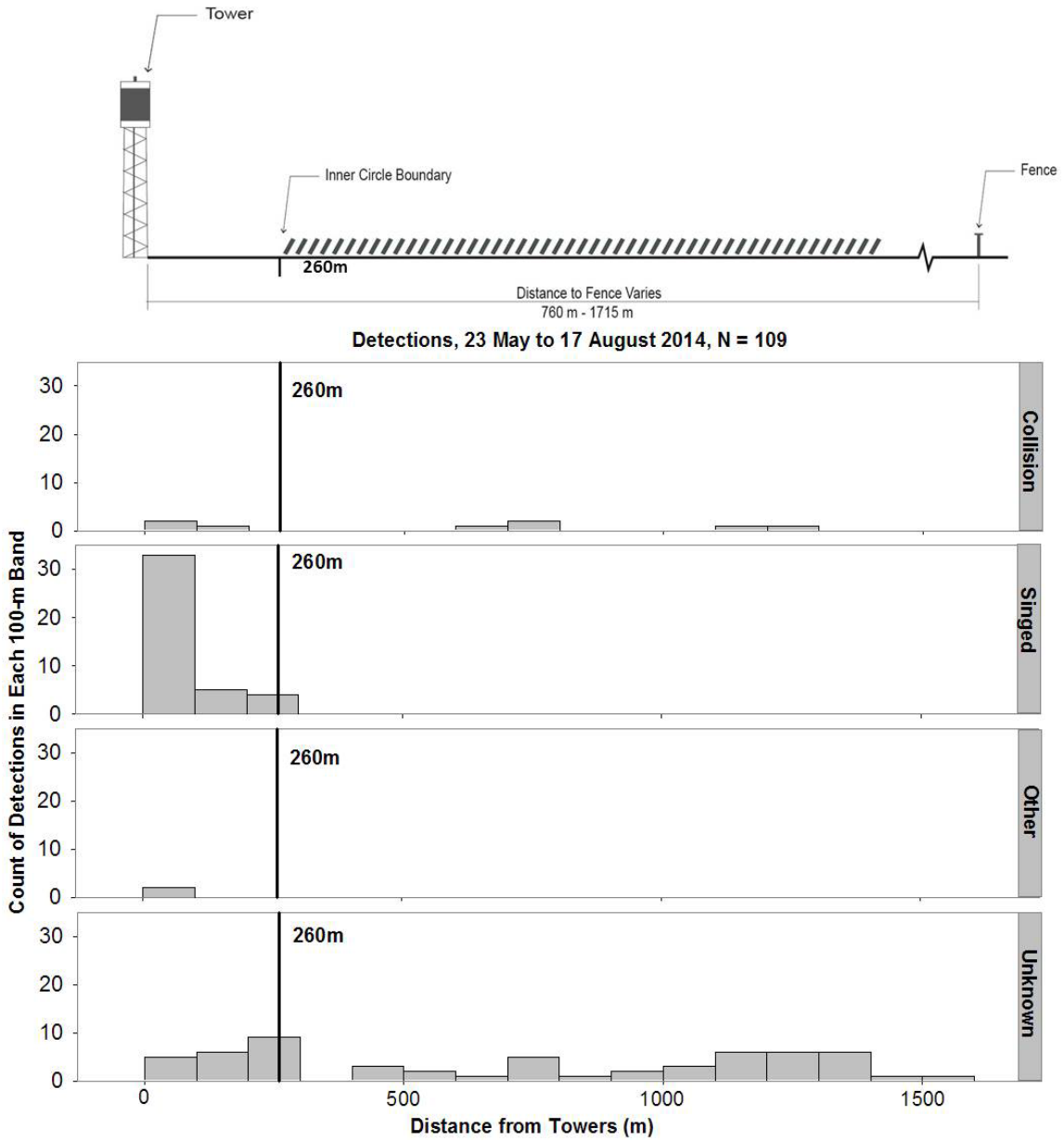
Of the 115 avian detections during the 2014 summer season, 42 detections (36.5%) showed signs of singed feather damage. None were raptors, 41 were small birds (≤ 100 g), and one (a Eurasian collared-dove) was a large bird. Table 15 indicates the number of detections in various parts of the Project site with and without evidence of singeing as confirmed through microscopic examination.

Table 15. Locations of Singed and Non-singed Bird Detections, 23 May – 17 August 2014.

Location	Singed	Non-Singed
Power Block	35	9
Inner HD Heliostats	7	15
Inner Segment Heliostats	0	6
Outer Segment Heliostats	0	34
Unit Perimeter Fences	0	3
CLA Fence	0	3
Unit 3 Collector Line	0	0
Offsite Control Transects	0	0
Other Project Lands	0	3
Total	42	73

Figure 21 depicts the total number of detections involving evidence of singeing, evidence of confirmed collision, from other Project causes, and with unknown cause of injury or death by distance from the power towers. The three incidental detections outside the solar units and three survey detections outside the unit fence lines and along the CLA fence (none of which were singed) are not shown so that Figure 21 focuses on the 109 detections in the solar units themselves. Figure 22 provides an overview of the spatial location of each detection showing evidence of singeing, collision effects, other Project causes, and unknown causes within the solar units.

Figure 21. Number of Avian Detections[1] Associated with Singeing, Collisions, Other Project Causes, and Unknown Injury/Fatality Causes by Distance from Towers.



[1] Only raw data are presented, so this graph does not take into account the increase in survey area as distance away from the tower increases. The detections in the "Other" category were detections found in the ACC buildings without evidence of singeing or collision effects. This figure excludes six avian detections (none of which were singed) found outside the unit fence lines.

All 42 detections showing evidence of singeing were discovered within 240 m of the towers.

IVANPAH 3

IVANPAH 2

IVANPAH 1

LEGEND

Detections (23 May – 17 August)

- Singed
- Collision
- Other
- Unknown
- Roads
- Project Site
- Search Area Divisions
- Tower Area (100% Coverage)

N 2000 1000 0 2000

Feet

N:\Projects\2802-01\07\Report\Summer 2014 Avian and Bat Monitoring Report\Fig 22 Locations of Singed and Unsinged Detections within Solar Units.mxd

H.T. HARVEY & ASSOCIATES
Ecological Consultants

Figure 22: Locations of Singed and Unsinged Detections within Solar Units

Ivanpah Summer 2014 Avian and Bat Monitoring Report (2802-07)

December 2014

4.3.2 Collisions

Of the 115 avian detections, evidence of collision was observed in 10 (8.7%). As described in Section 2.2.1.3, the evidence that was used to classify these detections as collisions was obvious physical trauma, proximity to heliostats that had smudge marks, body imprints, and/or feathers on or near the surface of the mirror (although birds that collide with structures do not always leave visible evidence). Six of the collisions were with heliostats. Of the remaining four collisions, two appeared to be with Project buildings, one with the tower, and one with either a vehicle or transmission line along Coliseum Road.

Evidence of collision with the ACC fans was observed in the case of six bats.

4.3.3 Other Project Causes

Two avian detections (1.7% of all detections) without evidence of singeing or collision effects were found in the external alleys of the ACC buildings. Although the cause of death for these two birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space, the ACC buildings. Section 3.1 of the Plan indicates that fatality estimates should include estimates for "other Project impacts" to accommodate such effects, and therefore these two detections are categorized being of "other Project causes".

Similarly, five bats were found in or near ACC buildings without evidence of singeing or collision effects. Although the cause of death for these bats remains unknown, their association with the ACC building provides direct evidence of the cause of death.

4.3.4 Detections of Unknown Cause

Aside from the 10 detections where evidence of collision was noted, the 42 detections with evidence of singeing, and the two detections of other Project causes, the cause of injury or mortality for the remaining 61 detections (53.0%) is not known with certainty, and no obvious evidence of the cause of mortality was observed for these detections. These 61 detections showed no evidence of collision effects, and microscopic analysis did not indicate signs of singeing. Of these unknown detections, nearly half (27) were feather spots.

Section 2.1 of the Plan requires that "If a large portion (i.e., more than 40 percent) of the detections cannot be determined, or presumed without a reasonable doubt to be caused by the facility, potential other causes, such as unrelated avian disease or a lightning event, will be considered and the analysis adjusted as appropriate in the seasonal report.". Therefore, we considered potential factors contributing to the fatality of these unknowns. During this summer, two avian detections without evidence of singeing or collision were found in the ACC buildings. Although the cause of death for these two birds was unknown, these were considered as providing direct evidence of the cause of death because they were found entrapped or within an enclosed space. We found no evidence that a large proportion of the remaining detections of unknown cause were temporally clumped (which might have suggested that discrete events such as lightning strikes or disease events had killed multiple birds). Thirty of the detections of unknown cause were in Unit 3, 13 were in Unit 2,

14 were in Unit 1, three were along fence lines, and one was along Coliseum Road (Figure 22). In Unit 3, slight clumping of detections of unknown cause were present around the tower and on outer arc segments in the southwest corner of the unit that were searched by detection dogs. In one instance, feather spots from four different birds were found clumped in a single location in the Unit 3 outer arc segments. Such clumping is most likely the result of predation or scavenging. American kestrels have been observed frequenting specific heliostats from which they may consume birds they have either predated or scavenged. White-tailed antelope squirrels (*Ammospermophilus leucurus*) have also been observed pulling scavenged carcass removal trial carcasses into burrows, leaving feather spots near the entrance. Apart from such evidence of predation or scavenging, no obvious explanation for any concentrations of detections of unknown cause was apparent. We thus concluded that there were no obvious, discrete explanations for these unknown fatalities.

No detections occurred along the Unit 3 Collector Line or offsite control areas. None of the bat detections showed evidence of singeing; this result is expected because bats have a low exposure rate to flux due to their crepuscular and nocturnal foraging habits. In the case of the live bat, heat stress or dehydration is the suspected case of illness; this bat was released after treatment with food, water, and rest in a cool place until nightfall.

4.4 Feather Spot Detections

The following section describes the number of detections that consisted only of feather spots and spatial patterns in the ratio of feather spots to carcass-based detections. Feather spots were considered detections when they consisted of at least two or more primary flight feathers, five or more tail feathers, or 10 or more feathers of any type concentrated together in an area 1 m^2 or smaller (Smallwood 2007); feathers with significant skin or flesh, or any bone, attached were classified as detections but were not considered feather spots.

Thirty-one (27.0%) of the 115 detections consisted only of feather spots. While evidence of singeing through direct and microscopic examination was noted on three of these 31 feather spots, and evidence of collision (i.e., an impact smudge on a nearby mirror) was noted in the case of one other feather spot, the causes of the feather spots for the other 27 birds is unknown. The proportions of these 31 feather spots representing fatalities (e.g., collision) that had been scavenged or representing natural predation events associated with kit foxes (*Vulpes macrotis*), common ravens, or raptors are not known. Furthermore, in some cases, multiple feather spots may result from one fatality, over-representing the number of fatalities. Nevertheless, all feather spots meeting minimum criteria (i.e., ≥ 10 feathers of any type, ≥ two primary feathers, or five or more tail feathers within an area 1 m^2 or smaller [Smallwood 2007]) were recorded as detections.

As indicated in Table 16, the ratio of feather spots to carcasses varied considerably across the Project site. It was highest along the perimeter and CLA fences (6:0 for all fences combined), and lowest in the power block (1:21), with the heliostat arrays (inner HD, inner and outer segments) closer to being equal. The change in ratio between the power block and heliostats could result from the rapidity with which carcasses around the

tower are detected by people, so that there is less time for scavenging that would result in feather spots. Feather spots around the relatively open power block may also be removed by the wind more easily than in the rest of the solar field and deposited in the inner HD heliostats.

Table 16. Ratios of Feather Spots to Carcasses Relative to Site Locations.

Location	Total	Feather Spots	Carcasses	Feather Spot: Carcass Ratio
Power Block	44	2	42	1:21
Inner HD Heliostats	22	10	12	1:1.2
Inner Segments	6	2	4	1:2.0
Outer Segments	34	11	23	1:2.1
Unit Perimeter Fence	3	3	0	3:0
CLA Fence	3	3	0	3:0
Unit 3 Collector Line	0	0	0	NA
Offsite Control Transects	0	0	0	NA
Other Project Lands	3	0	3	0:3
Total	**115**	**31**	**84**	**1:2.7**

Section 5.0 Fatality Estimation

This section utilizes the detection data as described in Section 4 to develop an overall fatality estimate in accordance with the Plan. The estimates of carcass removal rates and searcher efficiencies are derived and subsequently utilized in the model with the detection data to provide estimates for the facility areas as required in the Plan. The total estimate for the entire facility is presented separately for fatalities that can be attributed to the facility (i.e., with evidence of singeing or collision effects, or entrapped or within an enclosed space, such as the ACC buildings) and fatalities of unknown cause. Following presentation of the total fatality estimates, estimates are provided separately for the tower area, heliostats, and fence line.

5.1 Estimating Model Parameters

5.1.1 Carcass Removal Trials

We conducted 26 carcass removal trials during the 2014 summer season. These trials included 11 large carcasses and 15 small carcasses. Carcasses were placed in the inner HD heliostats and inner and outer heliostat segments, along the fence line, and on offsite control transects. A camera was placed at each carcass to record the time of scavenging and the scavenging species. Seven of the carcasses were placed around the power block after approval was granted late in spring to conduct carcass removal trials in that location. Scavenger species included common ravens (N=7), desert kit fox (N=5), white-tailed antelope squirrels (N=3), greater roadrunner (N=1), and an unidentified canid (N=1). For the remaining seven scavenged carcasses (two carcasses were not scavenged), the scavenger species was not captured on camera. Eleven feather spots or partial carcasses were created by scavengers consuming carcasses that we placed for carcass removal trials. Seven of these feather spots/partial carcasses were present through a full six-week trial period; these remains, which resulted from seven large carcasses, were collected at the end of the period. Nine of the 11 large carcasses were detected and at least partially eaten by scavengers. In eight of these instances, the scavengers left enough of the carcass that the remains would have been detectable by fatality searchers and considered a fatality if detected during the standardized searches. In two cases, large carcasses were removed completely: one by scavenging and one by relocation of the carcass more than 800 m from the original location by a kit fox. In contrast, small carcasses tended to be more completely removed, with none of 15 small carcasses leaving remains that persisted for the entire six-week trial.

Carcass persistence rates for the summer season ranged from less than one day, in the case of nine carcasses (one large and eight small), to a full six-week trial period in the case of the seven carcasses whose remains persisted throughout the trial. Figures 23 and 24 show the persistence durations for small and large carcasses throughout the facility. Carcasses placed on the power block are shown in red, while those placed elsewhere are shown in blue. The power block differs from the inner HD heliostats and the heliostat fields both in physical structure and human activity. It is therefore likely that scavenging rates and discovery rates of carcasses and feather spots in the power block are different from those within the heliostat area. However,

sample sizes for the summer season were too low to utilize separate estimates for the power block and non-power block areas in the fatality estimator.

Because seven of the carcasses persisted for the full six-week trial before being removed by the carcass removal trial team, it is unknown how long they might have persisted if not removed. We therefore conservatively assumed that carcasses would not have persisted beyond the time the trial ended and carcasses were retrieved (about 6 weeks). Mean carcass persistence was 4.9 days for small carcasses and 32.9 days for large carcasses. In comparison, the assumptions used in the power analysis in the Plan were 7.4 days for small birds and 21.8 days for large birds.

Figure 23. Persistence Durations for Small Carcasses Placed for Carcass Removal Trials (N = 15).

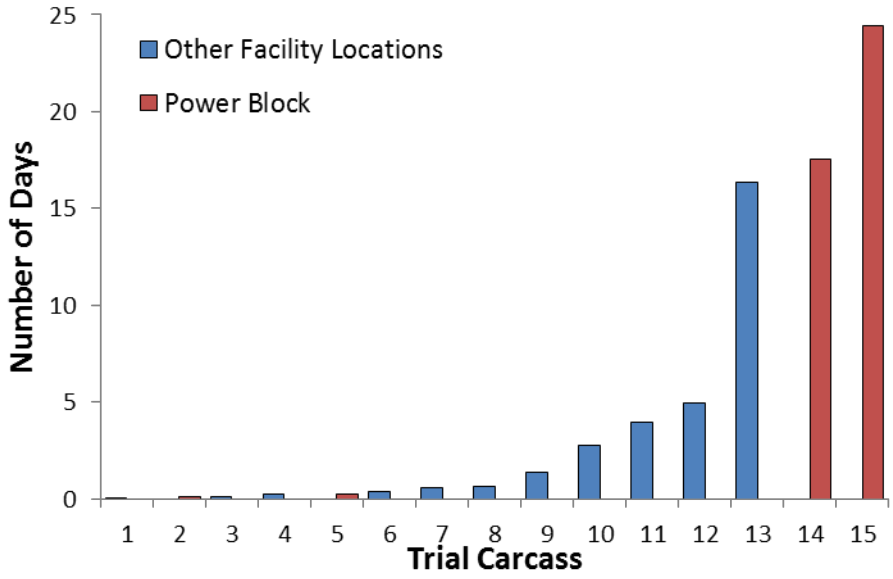
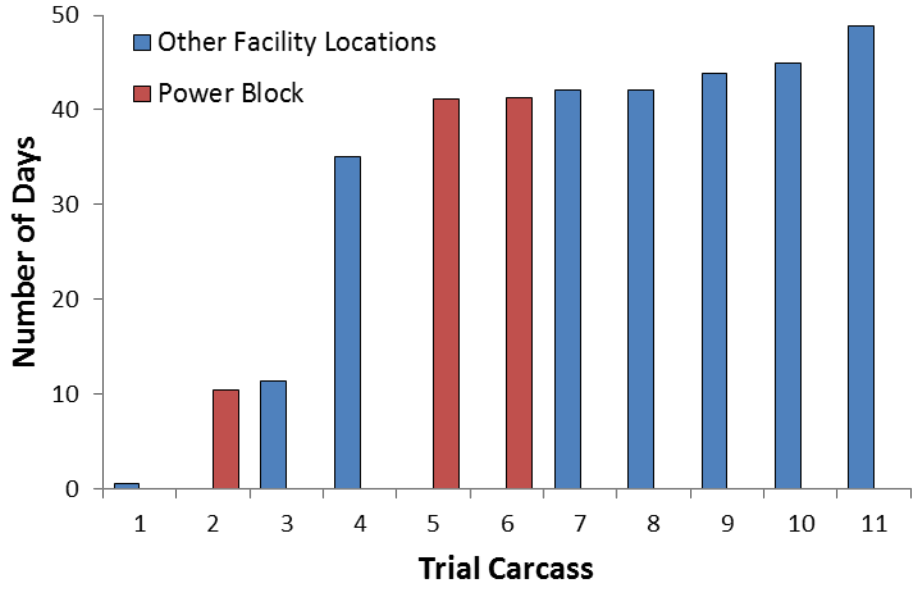


Figure 24. Persistence Durations for Large Carcasses Placed for Carcass Removal Trials (N = 11).



5.1.2 Model Selection for Carcass Removal Decay Curve

Based on the carcass removal data, eight selected survival models were compared for relative quality using the Akaike information criterion (AICc) score as suggested in Huso (2010). As a part of the fatality estimator process, Huso (2010) recommends measuring the relative quality of the estimator model for each set of data to determine which model to use. Thus, AICc provides a means for model selection. In other words, although the absolute value of AICc may vary, the difference in AICc values among models provides information about which model is most statistically supported.

There are four survival distributions that can be selected for modeling carcass persistence: Weibull, Exponential, Loglog, and Lognormal. AICc is used to select the most supported distribution, as well as select covariates (carcass size, habitat characteristics, etc.) to include in the carcass persistence distribution. Carcass size is a potentially important variable, as larger carcasses tend to persist longer and may be more likely to leave feather spots which persist for long durations, whereas smaller carcasses may be more likely to be completely removed. We ranked the four carcass persistence models with and without size using AICc (Table 17).

Table 17. AICc Values for Each of Four Distribution Models of Carcass Persistence, and Four Additional Models in Which Carcass Size Was Also Included.

Model	AICc	Shape	Proportion Persisting* (combined, or large / small)
Weibull	126.5	2.6	0.50
Exponential	156.0	1.0	0.67
Loglog	124.1	1.9	0.47
Lognormal	122.8	3.1	0.48
Weibull/Size	107.1	1.9	0.86 / 0.18
Exponential/Size	119.4	1.0	0.92 / 0.22
Loglog/Size	106.7	1.3	0.88 / 0.17
Lognormal/Size	106.0	2.2	0.86 / 0.18

* Indicates the proportion of carcasses expected to persist through the intended survey interval (21 days).

Although the model with the lowest AICc value is typically held to be the most supported, any model with a change in AICc values of less than two from the "best model" is considered to have strong evidence supporting it (Burnham and Anderson 2004). The loglogistic, lognormal, and Weibull models that included size had ΔAICc values <2, and we chose to use the Weibull model (a continuous distribution model) because it was equivalent to or better than the other model options and was the same model selected for the 2013-2014 winter and spring quarter fatality estimates.

5.1.3 Searcher Efficiency Trials

Human Searcher Efficiency Trials. During the 2014 summer season, a total of 19 small carcasses, 14 large carcasses, and 25 feather spots were placed in locations with various vegetation heights and with a range of contrast between the soil and vegetation to represent the various conditions under which searches occur. Carcasses were placed in all areas where searches occurred (i.e., the power block, inner HD area, inner and outer heliostats, fence lines, the Unit 3 collector line, and control transects). Two of the small carcasses and three large carcasses disappeared (e.g., they may have been scavenged) before the searcher efficiency trial, leaving a sample size of 17 small carcasses, 11 large carcasses, and 25 feather spots included in the trials.

Human searcher efficiency rates were generally higher on the power block than in other locations, but sample sizes of searcher efficiency trials on the power block were too small for differences to be analyzed statistically. As a result, all searcher efficiency trial results were pooled. When all summer searcher efficiency trials were combined, 100% of all large carcasses, 64.7% of all small carcasses, and 40.0% of all feather spots were successfully discovered by searchers, for a mean searcher efficiency of 60.4%.

Canine Searcher Efficiency Trials. During the 2014 summer season, 17 small carcasses, three large carcasses, and 130 small feather spots were placed in locations in the heliostat field with various vegetation heights and with a range of contrast between the soil and vegetation to represent the various conditions under which searches occur. Detection dog searcher efficiency for the summer period averaged 75.0% for carcasses

(three of three large carcasses detected and 12 of 17 small carcasses detected, or 15 of 20 detected overall) and 63.8% for feather spots. Searcher efficiency rates for carcasses were higher than the target rates assumed in the plan for both small and large bird carcasses. Canine searcher efficiency rates for feather spots were also higher than the Plan's target rate of 55% assumed for small birds. Canine searcher efficiency trials were split between feather spots and carcasses for canine teams without distinguishing carcasses by size (due to the low sample size [N=3] of large carcasses used in these trials). In summary, 75.0% of all carcasses, 63.8% of all feather spots that were planted were successfully discovered by searchers, for a mean searcher efficiency of 65.3%.

Model Selection for Searcher Efficiency Trials. The Plan states that searcher efficiency trials will be conducted during each season in which vegetation differs from the prior season, because changes in vegetative cover may affect carcass detectability. We did not make *a priori* decisions regarding whether vegetative cover would differ between seasons, but rather, we conducted searcher efficiency trials in summer as we did in spring and winter. Following the completion of summer searcher efficiency trials, we assessed whether the searcher efficiency rates differed significantly by season, in which case it might be inappropriate to pool seasonal searcher efficiency data, or not, in which case pooling across seasons would be useful to obtain a more robust sample.

To evaluate the hypothesis that there is no seasonal difference in carcass detectability, we constructed logistic regression models and used Akaike's Information Criteria, corrected for low sample size (AICc). We compared the null model to a model containing season as an explanatory variable, and found that AICc values for these two models differed by 5.05. A difference in AICc values of at least 2 would indicate that season is an important predictor of searcher efficiency; thus, we concluded that the model including season provides additional predictive power (Burnham and Anderson 2002). In addition to the AICc comparison, we conducted a likelihood ratio test to determine the statistical significance of season as a predictor and found it to be significant at the 95% confidence level ($p = 0.0093$). These analyses indicated that summer searcher efficiency rates differed significantly from those in winter and spring, and thus, pooling the winter, spring, and summer searcher efficiency data would be inappropriate. Therefore, only searcher efficiency trial data from the summer quarter were used in the summer fatality estimates. We will re-examine how best to integrate seasonal searcher efficiency data after a full year of surveying, as locations on sites of searcher efficiency trials vary by season and may affect these results.

The searcher efficiency model which included searcher type (human or dog), three detection-type categories (small carcass, large carcass, and featherspot) for humans, and fatality type (carcass or feather spot) for dogs had an AICc value 8.58 points lower (AICc = 258.64) than the null model that did not include any explanatory variables (AICc = 267.22). Therefore, we chose the model which accounted for searcher type, size, and fatality type. The searcher efficiency rates used in the fatality estimates are summarized in Tables 18 and 19.

Table 18. Human Searcher Efficiency Values for Detection-Type Categories.

Size	Found	Placed	Searcher Efficiency (90% CI)
Large Carcass	11	11	1 (1 – 1)
Small Carcass	11	17	0.65 (0.47 – 0.82)
Feather Spots	10	25	0.40 (0.24 – 0.56)

Table 19. Canine Searcher Efficiency Values for Detection-Type Categories.

Category	Found	Placed	Searcher Efficiency (90%CI)
Carcass	15	20	0.75 (0.60 – 0.90)
Feather Spot	83	130	0.64 (0.57 – 0.70)

5.2 Fatality Estimates for Known Causes

As per the Plan, facility-wide estimates of potential avian impacts are to be estimated based on the following:

1. Observed number of detections found during standardized searches in the monitoring season for which the cause of death can be determined and is facility-related
2. Non-removal rates, expressed as the estimated average probability that a potential detection is expected to remain in the study area and be available for detection by the observers, based on removal trials
3. Searcher efficiency, expressed as the proportion of placed trial carcasses found by observers during the searcher efficiency trials

After determining the proper model structure for both searcher efficiency and carcass persistence trials, we ran a series of fatality estimates. We report fatality estimates as per the requirements of the Plan and only for areas and categories with more than five detections because using the fatality estimator with five or fewer detections will produce highly biased values due to the small sample size.

Fatality estimates were calculated separately for the tower area (power block and inner HD heliostats), heliostat area, and fence line (unit perimeter and CLA fences). Estimates are initially provided for fatalities (where the cause of death is based upon direct evidence of singeing, collision, or other (entrapped or found within an enclosed space). Following the estimates where the cause of death is based upon these categories of direct evidence, an estimate is provided of fatalities where the cause could not be determined.

5.2.1 Total Fatality Estimates for Known Causes

Of the 54 detections where the cause of death or injury could be determined, 25 were included in the fatality estimate models, and 24 detections from the ACC buildings were added unadjusted to the estimator output, to produce the total fatality estimate (Table 20). Of the 24 from the ACC buildings, all were small birds; 21 were singed, one was collision-related, and two died of other Project causes. Of the five detections that were

outside the ACC buildings and that were not included in the fatality estimates, four were excluded because they were outside the standardized survey area and one was excluded because it was older than the search interval. None of the detections along the fences were of known causes.

Table 20. Number of Detections Based on Known Causes in Each Project Element, and Number Included in Fatality Estimates.

Element	Number Included	Number Excluded	Total Found
Power Block	14	25[1]	39
Inner HD	8	0	8
Inner and Outer Heliostats	3	2[2]	5
Fences	0	0	0
Other Project Areas	0	2[2]	2
Control Transects	0	0	0
Total	25	29	54

[1] One was excluded because it was older than the search interval and 24 were excluded because they were in the ACC buildings; these 24 were added unadjusted to the estimator output.

[2] These detections were excluded because they were outside the standardized survey area.

Table 21 provides the total fatality estimates for known causes for the 2014 summer season. These total estimates were calculated by adding the mean estimates and 90% confidence intervals for each Project component, which are discussed in the subsequent sections. Although fatality estimates are not provided in the fatality estimate tables below when the number of detections for any group (e.g., singeing, collision, singeing + collision, other Project causes, large bird, raptor, or small bird) was less than five, all singeing and collision-related detections, as well as detections from other Project causes, were included in the overall fatality estimates for known causes in Table 21.

Overall, there were an estimated 172 fatalities (90% confidence interval estimates 102-416) in summer 2014, based on detections with direct evidence of the cause of the fatality (i.e., singeing, collision, or other). As a result of low detections (fewer than five) in the heliostat areas, and none along fence lines, no fatality estimates attributable to known causes are provided for those Project elements. A total of 169 fatalities (90% confidence interval estimates 99-413) attributed to a specific cause (i.e., singeing, collision, or other) were estimated to be in the tower area during the period 23 May – 17 August 2014. Note that estimates from the power block (a sub-area of the tower area) should be interpreted with caution due to unaccounted-for search effort from other Project personnel. Incorporating the unaccounted-for search effort by Project personnel responsible for incidental detections may necessitate future revision of these estimates (e.g., after a full year of monitoring).

Table 21. Estimates of Total Detections with Known Causes Based on Fatality Searches in all Areas, 23 May – 17 August 2014.

Project Element	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Tower Area	22[1]	169 (99-413)[2]
Heliostat Area	3	NA[3]
Fences	0	NA[3]
Summer Total	**25**[1]	**172** (102-416)[4]

[1] The 24 detections in the ACC buildings are not included in the number of detections included in the model for the tower area (or the overall model) because they were added to the fatality estimator output unadjusted.

[2] Note that the tower area estimate includes estimates for the power block, which should be interpreted with caution as they may be inaccurate due to the large amount of unaccounted for search effort. The fatality estimates for the tower area include the 24 detections in the ACC buildings, which were added unadjusted to the fatality estimator results.

[3] NA = not applicable because there were no fence line detections that could be attributed to known causes.

[4] The overall fatality estimates include the 24 detections in the ACC buildings and the three in the heliostat area, which were added unadjusted to the fatality estimator results.

5.2.2 Fatality Estimate for Tower Area

Tables 22 and 23 provide fatality estimates for known causes within the power block and inner HD heliostats for the 2014 summer monitoring period 23 May – 17 August 2014, while Table 24 provides the total fatality estimates for known causes for the tower area as a whole. We included incidental detections when they were found in areas covered during standardized surveys or on the tower, during time periods in which they were being searched. Because of the high amount of unaccounted-for searching (i.e., resulting in incidental detections) in the power block, we are providing fatality estimates separately for the power block vs. inner HD heliostats in Tables 22 and 23 below. However, fatality estimate results from these two areas, and detections from the ACC building, are pooled for tower area fatality estimates provided in Table 21. Estimates from the power block should be interpreted with caution. Because detections were observed more frequently in the power block (a sub-area of the tower area) than otherwise expected if detections were made only through the fatality monitoring (and not with the addition of incidental detections made by other personnel), the total fatality estimates for the power blocks currently may be inaccurate.

Table 22. Estimates by Cause (a.) and Size Class (b.) of Total Detections with Known Causes Based on Fatality Searches in Power Blocks, 23 May – 17 August 2014.

22a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	13[1]	88 (61-188)[2]
Collision	1[3]	NA[4]
Other	0[5]	NA[4]
Total	**14[6]**	**93** (66-194)[7]

[1] The 21 singed detections in the ACC buildings are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[2] The 21 singed detections in the ACC buildings were added unadjusted to the singed fatality estimates.

[3] One collision-related detection in an ACC building was not included in the number of detections included in the model, but per note 7, was added unadjusted to the fatality estimator results.

[4] NA = not applicable because there were fewer than five detections within that group.

[5] Two detections found in the ACC buildings without evidence of singeing or collision effects are considered detections from "other Project causes"; they were not included in the model because there were fewer than five detections, but per note 7, they were added unadjusted to the fatality estimator results.

[6] The 24 detections in the ACC buildings are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[7] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The fatality estimate includes the 24 detections with known cause in the ACC buildings, which were added unadjusted to the fatality estimator results.

22b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	0	NA
Raptor	0	NA
Small Bird	14[1]	93 (66-194)[2]
Total	**14[1]**	**93** (66-194)[2]

[1] The 24 detections in the ACC buildings (all small birds) are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The fatality estimate includes the 24 detections in the ACC buildings, which were added unadjusted to the fatality estimator results.

Table 23. Estimates by Cause (a.) and Size Class (b.) of Total Detections with Known Causes Based on Fatality Searches in Inner HD Heliostats, 23 May – 17 August 2014.

23a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	7	67 (28-199)
Collision	1	NA[1]
Total Singeing + Collision	**8**	**76** (33-219)[2]

[1] NA = not applicable because there were fewer than five detections within that group.

[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

23b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[1]
Raptor	0	NA
Small Bird	7	75 (33-218)
All Detections	**8**	**76** (33-219)[3]

[1] NA = not applicable because there were fewer than five detections within that group.

[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

Table 24. Estimates by Cause (a.) and Size Class (b.) of Total Detections with Known Causes Based on Fatality Searches in the Tower Area, 23 May – 17 August 2014.

24a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	20[1]	155 (89-387)[2]
Collision	2[3]	NA[4]
Other[5]	0	NA[4]
Total	**22[6]**	**169** (99-413)[7]

[1] The 21 singed detections in the ACC buildings are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[2] The 21 singed detections in the ACC buildings were added unadjusted to the singed fatality estimates.

[3] One collision-related detection in an ACC building was not included in the number of detections included in the model but per note 7, was added unadjusted to the fatality estimator results.

[4] NA = not applicable because there were fewer than five detections within that group.

[5] Two detections found in the ACC buildings without evidence of singeing or collision effects are considered detections from "other Project causes"; they were not included in the model because there were fewer than five detections, but per note 7, they were added unadjusted to the fatality estimator results.

[6] The 24 detections in the ACC buildings are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[7] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The fatality estimate includes the 24 detections with known cause in the ACC buildings, which were added unadjusted to the fatality estimator results.

24b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[2]
Raptor	0	NA
Small Bird	21[1]	168 (99-412)[3]
Total	**22**[1]	**169** (99-413)[3]

[1] The 24 detections in the ACC buildings (all small birds) are not included in the number of detections included in the model, but they were added to the fatality estimator output unadjusted.

[2] NA = not applicable because there were fewer than five detections within that group.

[3] Totals do not reflect the sum of individual estimates because of "NA" values less than five. The fatality estimate includes the 24 detections in the ACC buildings, which were added unadjusted to the fatality estimator results.

5.2.3 Fatality Estimate for Heliostat Area

Table 25 provides fatality estimates for known causes within the heliostat area for the 2014 summer season, 23 May – 17 August 2014.

Table 25. Estimates by Cause (a.) and Size Class (b.) of Detections with Known Causes within the Heliostat Area, 23 May – 17 August 2014.

25a. Estimates by Cause

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Singeing	0	NA
Collision	3	NA[1]
Total Singeing + Collision	**3**	NA[1]

[1] NA = not applicable because there were fewer than five detections within that group.

25b. Estimates by Size Class

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[1]
Raptor	0	NA
Small Bird	2	NA[1]
All Detections	**3**	NA[1]

[1] NA = not applicable because there were fewer than five detections within that group.

5.2.4 Fatality Estimate for Fence line

The perimeter fence lines for all units, as well as the CLA fence, were surveyed throughout the full summer period. No detections found along fences could provide direct evidence of singeing, collision, or other (i.e., cause of death was unknown), so we do not provide a fatality estimate for known causes based on fence line surveys during this seasonal period.

5.3 Fatality Estimates from Unknown Causes

Per Section 3.1 of the Plan, fatality estimates are also to be provided based on detections of birds that were injured or that died of unknown causes. Because no observable evidence of singeing or collision effects was noted in the case of these unknown detections, they cannot be clearly included in an estimate attributed to a specific cause (i.e., singeing or collision). The methods for determining fatality estimates for these unknown detections are the same as those described in Section 5.2 for detections with direct evidence of the cause of the fatality (i.e., singeing, collision, or other).

There were 61 detections where the cause of death could not be determined. Of these 61, 35 were included in the estimates; in addition, one detection (of unknown size) from the inner HD area and four detections along the fence line were added unadjusted to the output of the fatality estimator to produce the total fatality estimate from unknown causes (Table 26). The 21 unknown detections that were excluded from the estimates altogether included 17 that were estimated to be older than the search interval; three that were within solar units but outside our survey plots; and one that was on "other Project lands" outside the solar units.

Table 26. Number of Detections from Unknown Causes in Each Project Element, and Number Included in Fatality Estimates.

Element	Number Included	Number Excluded	Total Found
Power Block	5	0	5
Inner HD	11	3[1]	14
Inner and Outer Heliostats	19	16[2]	35
Fences	0	6[3]	6
Other Project Areas	0	1[4]	1
Control Transects	0	0	0

[1] Two detections were estimated to be older than the search interval, and one could not be placed in a size category and was added to the estimate unadjusted.

[2] Eight detections were estimated to be older than the search interval, and eight were found outside of survey areas.

[3] Four detections would have been included in an estimate, but due to sample size of less than five, no estimate was provided for fences; however, these were added to the overall fatality estimate unadjusted. Two were estimated to be older than the search interval.

[4] No estimate was provided for "other Project areas".

5.3.1 Total Fatality Estimates from Unknown Causes

Total fatality estimates from unknown causes were calculated as described in Section 5.2.1 above. During the period of 23 May – 17 August, the total estimate of fatalities from unknown causes was 714. Of this estimate, 112 (90% confidence interval estimates 30-348) were in the tower area, 598 (90% confidence interval estimates 346-1495) in the heliostat area, and four in the fence line area (Table 27). Note that the four detections discovered in the fence line areas and one additional detection discovered in the inner HD heliostats that could not be identified to size class were added unadjusted. The latter could not be included in the estimation because size class is a required attribute if either the searcher efficiency or carcass persistence sub-models include size as a variable.

Table 27. Site-Wide Fatality Estimates from Unknown Causes, 23 May – 17 August 2014.

Type of Estimate	Number of Detections Included	Site Wide Estimate
Tower Area	16[1]	112 (30-348)[2]
Heliostat Area	19	598 (346-1495)
Fences	0[3]	NA[4]
Total Detections, Unknown Cause	**35[5]**	**714 (380-1847)[6]**

[1] The number of detections does not include a feather spot of unknown size that was discovered in the inner HD heliostats but per note 6, it was included unadjusted to the fatality estimator results.

[2] Note that the tower area estimate includes estimates for the power block, which should be interpreted with caution as they may be inaccurate due to the large amount of unaccounted for search effort.

[3] The number of detections does not include four fence line detections, but per note 6, they were included unadjusted to the fatality estimator results.

[4] NA = not applicable because there were fewer than five detections within that group.

[5] The number of detections does not include a feather spot of unknown size that was discovered in the inner HD heliostats, or four fence line detections.

[6] Totals do not reflect the sum of individual estimates because of "NA" values less than five. This estimate includes a feather spot of unknown size that was discovered in the inner HD heliostats and four fence line detections, all of which were added unadjusted to the total estimate.

5.3.2 Fatality Estimate for Tower Area

Table 28 provides fatality estimates from unknown causes for the power block for the 2014 summer period. Table 29 provides fatality estimates from unknown causes for the inner HD area, and Table 30 provides fatality estimates for the full tower area.

Table 28. Power Block Fatality Estimates from Unknown Causes, 23 May – 17 August 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	1	NA[1]
Raptor	0	NA
Small Bird	4	NA[1]
Total Detections, Unknown Cause	**5**	**41** (7-145)[2]

[1] NA = not applicable because there were fewer than five detections within that group.

[2] Totals do not reflect the sum of individual estimates because of "NA" values less than five.

Table 29. Inner HD Heliostats Fatality Estimates from Unknown Causes, 23 May – 17 August 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	4	NA[1]
Raptor[2]	1	NA[1]
Small Bird	6	61 (22-188)
Unknown Size	0[3]	NA[1]
Total Detections, Unknown Cause	**11**[3]	**71** (25-203)[4]

[1] NA = not applicable because there were fewer than five detections within that group.

[2] All raptors are also considered large birds, but they were considered separately to avoid having redundant data in this table; therefore, the "large bird" and "raptor" detections should be summed to determine the total number of "large bird" detections.

[3] The number of detections does not include a feather spot of unknown size.

[4] Totals do not reflect the sum of individual estimates because of "NA" values less than five. Estimate includes one detection that could not be assigned a size class, which was added unadjusted.

Table 30. Tower Area Fatality Estimates from Unknown Causes, 23 May – 17 August 2014.

Type of Estimate	Number of Detections Included	Site Wide Estimate
Large Bird	5	9 (5-18)
Raptor[2]	1	NA[1]
Small Bird	10	103 (28-336)
Unknown Size	0[3]	NA[1]
Total Detections, Unknown Cause	**16**[3]	**112** (30-348)[4]

[1] NA = not applicable because there were fewer than five detections within that group.

[2] All raptors are also considered large birds, but they were considered separately to avoid having redundant data in this table; therefore, the "large bird" and "raptor" detections should be summed to determine the total number of "large bird" detections.

[3] The number of detections does not include a feather spot of unknown size that was discovered in the inner HD heliostats.

[4] Totals do not reflect the sum of individual estimates because of "NA" values less than five. Estimate of total includes one found in the inner HD heliostats that could not be assigned a size class, but that was added unadjusted to the total estimate.

5.3.3 Fatality Estimate for Heliostat Area

Table 31 provides fatality estimates from unknown causes for the heliostat area for the 2014 summer period.

Table 31. Heliostat Area Fatality Estimates from Unknown Causes, 23 May – 17 August 2014.

Type of Estimate	Number of Detections Included in Model	Estimate of Site-Wide Detections (with Lower and Upper C.I.)
Large Bird	5	48 (17-102)
Raptor	0	NA
Small Bird	14	551 (293-1442)
Total Detections, Unknown Cause	**19**	**598** (346-1495)

5.3.4 Fatality Estimate for Fence line

Because of the low number of fence line detections during the 2014 summer monitoring period (i.e., fewer than the five detections necessary for a fatality estimate), we do not provide a fatality estimate for the fence line.

5.4 Regional Awareness Monitoring

According to the Plan, a communication protocol was implemented to monitor local veterinarians, game wardens, and wildlife rehabilitation facilities during facility operations to determine if significant new incidences of avian injury or fatality are reported to occur in the facility vicinity and region.

The Animal Kingdom Veterinary Hospital is the closest veterinary clinic to the Ivanpah facility and is located in the Las Vegas area about 35 miles northeast of Ivanpah. This clinic is also serves as a wildlife rehabilitation facility, so it was contacted and interviewed as a part of the protocol. Likewise, the local district game warden for the BLM and a field supervisor for CDFW were contacted to determine if they had noticed an increase in avian fatalities in the area or if they had noticed any singed or scorched injured or dead birds. Further, a designated biologist and veterinarian, Dr. Craig Himmelwright, working in the Ivanpah Valley was also interviewed for the same purpose. The following is a summary of results of interviewing these contacts for the purpose of the Regional Awareness Monitoring effort.

A representative from the Animal Kingdom Veterinary Hospital; Ryan Regnell representing the BLM; Craig Himmelwright, D.V.M. in Ivanpah Valley representing the Designated Biologists for the Project; and Magdalena Rodriquez from CDFW were contacted on 18 September 2014. Each reported that they were not aware of any increase in avian fatalities for the region or any birds, injured or dead, which had been found with singed or scorched feathers since monitoring according to the Plan began at Ivanpah in early winter 2013-2014.

Section 6.0 Discussion

The 2014 summer season represented the continuation of standardized monitoring of avian and bat detections and avian use of the Ivanpah site per the Avian & Bat Monitoring and Management Plan. Searcher efficiency trials and carcass removal trials were conducted concurrently on the power block, heliostat fields, and fence lines.

Caution is necessary when drawing conclusions from the 2014 summer season monitoring results because of the relatively small number of detections relative to the several Project elements of interest (e.g., heliostat fields, tower, fence line, and powerlines) and the variable sampling effort within the power block. Estimates of fatalities from the power block may be inaccurate because of the moderate number of incidental detections, which resulted in more detections than would be expected if detections were made only through the fatality monitoring. More extensive and robust conclusions will be possible at the end of the first full year of sampling.

6.1 Fatality Estimates

During the period 23 May – 17 August 2014, there were an estimated 172 fatalities (90% confidence interval estimates 102-416) with direct evidence of the cause of death (i.e., singeing, collision, or entrapment). As a result of low detections (fewer than five) in the heliostat areas, and none along fence lines, no fatality estimates based upon detections with direct evidence of the cause are provided for those Project elements. A total of 169 fatalities (90% confidence interval estimates 99-413) based upon detections with direct evidence of singeing, collision, or entrapment were estimated within the tower area.

As noted above, these estimates (and particularly the magnitude of the estimates) should be considered with caution given the limited dataset for the 2014 summer season. Additionally, the large amount of uncontrolled search effort in the power block complicates fatality estimation in this area. Nevertheless, the relative magnitude of the fatality estimates among the three search areas (tower area, heliostat area, and fence line) matches the pattern of detections observed. In proportion to unit area, fatality estimates suggest the highest densities of detections in the tower area, where heliostat density is highest and all of the detections with evidence of singeing were found.

6.2 Carcass Removal and Searcher Efficiency Trials

For the summer season, overall human searcher efficiency rates were 100% for large carcasses, 64.7% for small carcasses, and 40.0% for feather spots. Detection rates on the power block were higher than on other parts of the facility, but sample sizes of searcher efficiency trials on the power block were too small for differences to be analyzed statistically. Detection rates of carcasses were higher than the target rates of 69%

for large carcasses and 55% for small carcasses assumed in the Plan. In contrast, detection rates for feather spots were somewhat lower than the target rates.

Canine detection rates were higher than those of humans, with 75.0% of carcasses and 63.8% of feather spots detected. These rates are higher than the target rates assumed in the plan for both large and small birds.

6.3 Cause and Distribution of Fatalities

The cause of death for 36.5% of the 115 avian detections during the 2014 summer season was attributed to singeing, with 8.7% attributed to collision and 1.7% to other Project causes; 53.0% could not be confirmed (i.e., the carcass or feather spot displayed no signs of singeing and no direct collision effects as determined by microscopic examination by CEC and BLM approved biologists); almost half of the unknown detections (27 out of 61) were feather spots.

All detections showing evidence of singeing were detected in the relatively limited tower area. This 260-m radius area consisted of the area that was searched with 100% coverage due to proximity to the towers and is coincidental with the areas with the highest concentrations of solar flux. In addition, these towers were the focus of considerable activity by Ivanpah personnel, who found and reported detections, resulting in high numbers of incidental fatality reports.

6.4 Feather Spots

Thirty-one (27.0%) of the 115 detections consisted only of feather spots. While evidence of singeing was noted on three of these 36 feather spots, and evidence of collision was apparent in one feather spot, the cause of mortality for the other 27 birds is unknown. Some of these feather spots may have represented detections resulting from collisions or singeing that had been scavenged, leaving no direct evidence of the cause of the fatality. Other feather spots may represent natural predation events and multiple feather spots may be generated by these events. The large proportion of feather spots among the detections for the site as a whole may inflate the fatality estimate as a result of the potential for multiple feather spots resulting from one fatality, feather spots resulting from predation, or other causes. The ratio of feather spots to carcasses varied across the site, with a high ratio along the fence lines, near equal ratios in the heliostats and inner HD area, and a very low ratio on the power block.

6.5 Incidental Detections

A total of 27 incidental avian detections and two incidental bat detection were found during this quarter. Thus, incidental detections represented a moderate percentage (23.5% for birds and 16.7% for bats) of the detections. This demonstrates that the Ivanpah Wildlife Incident Reporting System, described in Section 3.4 of the Plan, is functioning well. However, a number of these incidental detections were retrieved from the power block, and the retrieval of incidental detections from the power block can confound accurate fatality estimates for this area because the search effort involved in the detection of incidental detections is not

quantifiable and is subject to considerable spatial and temporal variability. Because incidental detections are retrieved at random intervals, we cannot properly assess the search interval of detected carcasses, or searcher efficiency of personnel finding detections in these areas, which are both critical model parameters when estimating fatalities. Nevertheless, incidental detections from the power block were included with an assumed one day search interval in the fatality estimates because such a large proportion of detections in this area were incidental.

Because a high proportion of detections on the site are found in and around the power block and the current estimation protocol relies on a lower searcher efficiency than is likely reflected in the power block, we proposed a change in the proposed protocol for estimating searcher efficiency and accounting for detections in the power block area. This approach, if implemented by the facility, was approved by the TAC during the September meeting.

Section 7.0 Framework for Management and Risk Response

According to the Plan, quarterly reports are expected to categorize potential migratory bird mortality issues at Ivanpah as high, medium, or low to provide an appropriate biological basis for TAC review and decision making, based on the following definitions in Section 5.3 of the Plan:

1. "High: Estimated avian mortality or injury levels are facility-caused and likely to seriously and negatively affect local, regional, or national avian populations within a particular species or group of species."
2. "Medium: Estimated avian mortality or injury levels are facility-caused and have the potential to negatively affect local, regional, or national populations within a particular avian species or group of species."
3. "Low: Estimated avian mortality or injury levels that have minimal or no potential to negatively affect local, regional, or national populations within a particular species or group of species."

Only limited conclusions can be drawn from the summer 2014 season fatality data owing to the low numbers of detections within "a particular species or group of species"; however, the results indicate that the potential migratory bird mortality would be categorized as low. The 115 avian detections included 36 different bird species. Of these 36 species, 27 were represented by three or fewer detections (injury or fatality; see Table 10). While special-status species are discussed further below, all of the species represented by three or fewer detections have populations that are great enough locally (either as breeders, wintering birds, or migrants), regionally, and nationally that the loss of individuals indicated by the detected fatalities would have no substantive impact on populations at any of these geographic scales.

None of the nine species represented by more than three detections is particularly rare locally, regionally, or nationally. Seven of these nine species, including the mourning dove, black-throated sparrow, house finch, horned lark, tree swallow, cliff swallow, and Anna's hummingbird, are abundant and widespread species. Two others, the lesser nighthawk and greater roadrunner, have more limited breeding distributions but are still numerous within their breeding ranges and occur in large numbers (as a migrant in the case of lesser nighthawk and as a year-round resident in the case of greater roadrunner) in southeastern California. Thus, the magnitude of detections of these species at Ivanpah during the 2014 summer season does not rise above the "low" category.

The special-status species recorded as detections were one bank swallow (a state-listed species), two yellow warblers (a California species of special concern), and single individuals of olive-sided flycatcher, loggerhead shrike, and yellow-headed blackbird, which are also California species of special concern. Loggerhead shrikes breed in the vicinity of the site, but all the other special-status species recorded as detections were transients that breed elsewhere.

The cause of injury or mortality for 61 of the 115 detections (53.0%) is not known with certainty, and thus these detections cannot be accurately assigned to a known cause (i.e., singeing, collision, or other). Of the special-status species recorded, the bank swallow, the olive-sided flycatcher, and one of the yellow warblers showed signs of singeing, but the cause of death of the second yellow warbler, the loggerhead shrike, and the yellow-headed blackbird were unknown.

Bank swallows are widespread breeders throughout the middle and northern latitudes of North America (Garrison 1999). These birds completely vacate North America in winter, and as a result, large numbers migrate through southern North America (including southeastern California) in spring and fall en route between breeding and wintering areas. The bank swallow detection in summer 2014 represented a very small proportion of the bank swallows expected to migrate through the Ivanpah area, heading to and from breeding sites as far north as Alaska and Canada. The North American population of this species is estimated at 13,800,000 birds (http://birds.audubon.org/species/banswa), and the species is found throughout most of Europe and Asia as well, with a global population estimate of 46,000,000 individuals (http://birds.audubon.org/species/banswa). The most recent estimate available of the California breeding population numbered approximately 9,590 pairs in 2003 (bird species accounts at http://www.dfg.ca.gov/wildlife/nongame/t_e_spp/); numbers of burrows, which can be used to identify trends in abundance when monitored over time but which over-represent the actual numbers of breeding pairs, were estimated at 15,000 along the Sacramento River in 2012 (Bank Swallow Technical Advisory Committee 2013). Thus, at scales from local/regional (i.e., migrants moving through the Ivanpah area and the surrounding region) to national to global, the bank swallow detection at Ivanpah during the 2014 summer season does not rise above the "low" category, as loss at this magnitude would have a minimal effect on populations at any of these geographic scales.

The loggerhead shrike is declining over much of its range (Sauer et al. 2014), primarily due to habitat loss, but it remains a common and widespread bird throughout much of the western and southeastern United States where habitat remains. In California, this species is common in desert habitats. The southeastern deserts represent one of the areas of highest abundance in the state (Humple 2008), and Breeding Bird Survey data indicate no significant population trends, or perhaps even a slight increase, in the Mojave Desert since the mid-1960s (Sauer et al. 2014). The North American population of this species is estimated at 2,900,000 birds (http://birds.audubon.org/species/logshr). The detection recorded on the site, which could not be clearly attributed to a known cause, indicates a low number of impacted individuals that would not substantially affect local, regional, or national populations of the species; thus the summer 2014 detection does not rise above the "low" category.

Olive-sided flycatcher, yellow warbler, and yellow-headed blackbird are sufficiently abundant at all geographic scales that the loss indicated by the detections would have a minimal impact on local, regional, and national populations. Further, the cause of mortality of one yellow warbler and the yellow-headed blackbird could not be determined. For these reasons, the few detections of these three California species of special concern do not rise above the "low" category.

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Appendix A. Individual Avian Detections.

USFWS #	Common Name	Species Code[1]	Number Individuals	How Found	Collection Date	Bird/Carcass Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury /Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014-262-ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/28/2014	Feather spot	3-6 days	L partial wing (four primaries).	Unknown	NA	3	11 S 637382 3937791	Heliostat	Changed carcass condition to "feather spot" on 10/14/14 (B. Sousa)
2014-263-ISEGS	Pine Siskin	PISI	1	Carcass Survey	5/28/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	whole carcass. R wing coverts and secondaries singed and curled. Head, nape and rupm singed. L wig coverts and tail singed.	Scorched or singed	1, 3	3	11 S 637471 3937974	ACC Building°	
2014-264-ISEGS	Townsend's Warbler	TOWA	1	Carcass Survey	5/28/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Entire dorsal surface, face, and all flight feathers singed and curled.	Scorched or singed	1, 3	3	11 S 637480 3937965	ACC Building°	
2014-265-ISEGS	Costa's Hummingbird	COHU	1	Carcass Survey	5/28/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	L tail curled and singed; R tail, L flank, and L head singed.	Scorched or singed	1, 3	3	11 S 637480 3937963	ACC Building°	
2014-266-ISEGS	Northern Rough-winged Swallow	NRWS	1	Carcass Survey	5/28/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	all retrices singed and curled. L wing tips singed. All right wing feathers singed. Crown, rump, and some dorsal feathers singed.	Scorched or singed	1, 3	3	11 S 637462 3937942	ACC Building°	
2014-267-ISEGS	Lapland Longspur	LALO	1	Carcass Survey	5/28/2014	Dead, fresh (eyes moist)	3-6 days	No external trauma present; no singeing	Collision with solar panel/heliostat	NA	3	11 S 637580 3937824	Heliostat	
2014-268-ISEGS	Horned Lark	HOLA	1	Carcass Survey	5/28/2014	Feather spot	2 weeks	2 retrices, 9 remiges, ~20 contour feathers	Unknown	NA	3	11 S 637434 3937984	Light Pole	
2014-269-ISEGS	Greater Roadrunner	GRRO	1	Carcass Survey	5/28/2014	Feather spot	3 weeks	17+ flight feathers, 20+ contour feathers	Unknown	NA	3	11 S 637298 3938952	Fencing	
2014-270-ISEGS	Greater Roadrunner	GRRO	1	Carcass Survey	5/28/2014	Feather spot	3 weeks	3 flight feathers.	Unknown	NA	3	11 S 636871 3939135	Fencing	
2014-271-ISEGS	Brown-headed cowbird	BHCO	1	Carcass Survey	5/28/2014	Mummified	3 weeks	Carcass missing head. No sign of singeing or collision.	Unknown	NA	3	11 S 637332 3937667	Heliostat	
2014-272-ISEGS	Hermit Warbler	HEWA	1	Incidental	5/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Brain scavenged, otherwise no sign of external injuries.	Unknown	NA	2	11 S 638677 3935857	Project Building	
2014-273-ISEGS	Mourning Dove	MODO	1	Carcass Survey	5/29/2014	Feather spot	2 weeks	20+ flight feathers and 100+ body feathers. Smudge on mirror.	Collision with solar panel/heliostat	NA	3	11 S 636670 3937127	Heliostat	Changed azimuth to Project feather from ESE to SE on 10/27/14 (B. Sousa)
2014-274-ISEGS	Anna's Hummingbird	ANHU	1	Incidental	5/29/2014	Dead, fresh (eyes moist)	0-8 hours	Singed on rump, Right side of face, and right flank. Tail singed and curled.	Scorched or singed	1, 3	3	11 S 637532 3937975	ACC Building	
2014-275-ISEGS	Unknown	UNKN	1	Carcass Survey	6/2/2014	Feather spot	2 weeks	10 body feathers and some tissue attached	Unknown	NA	2	11 S 638509 3935679	Heliostat	

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2014-276-ISEGS	Lazuli Bunting	LAZB	1	Carcass Survey	6/2/2014	Dead, fresh (eyes moist)	8-24 hours	whole carcass; Singed tail and wing feathers. Singeing grade 2	Scorched or singed	2, 3	2	11 S 638563 3936007	Heliostat	
2014-277-ISEGS	Calliope Hummingbird	CAHU	1	Carcass Survey	6/2/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Whole carcass; singed dorsal rump and contour feathers, singed side of face. Singeing grade 3	Scorched or singed	3	2	11 S 638644 3935920	ACC Building°	
2014-278-ISEGS	Anna's Hummingbird	ANHU	1	Carcass Survey	6/2/2014	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Singed tail and wing feathers; singed side of head; singed flank and dorsal rump. Singeing grade 2	Scorched or singed	2, 3	2	11 S 638660 3935860	Solar Concentrating Tower	
2014-279-ISEGS	Anna's Hummingbird	ANHU	1	Carcass Survey	6/2/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Whole carcass. Body charred; tail feathers completely burned off; dorsal rump and both flanks charred; all but outer wing feathers singed off; head charred; all of back singed; fluid came out of bill; singeing grade 2 and 3.	Scorched or singed	2, 3	2	11 S 638647 3935835	Solar Concentrating Tower	
2014-280-ISEGS	Horned Lark	HOLA	1	Carcass Survey	6/3/2014	Feather spot	7 days	8 tail feathers, 10 body feathers; no singeing	Unknown	NA	2	11 S 638210 3935759	Heliostat	Changed species from UNKN to HOLA juvenile on 10/14/14 (B. Sousa)
2014-281-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/5/2014	Broken up	3 weeks	detached wings, head, body and flight feathers; majority of body feathers present	Unknown	NA	2	11 S 639026 3936535	Heliostat	
2014-282-ISEGS	House Finch	HOFI	1	Incidental	6/6/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass with singed feathers.	Scorched or singed	1	1	11 S 640335 3933474	Solar Concentrating Tower	
2014-283-ISEGS	Blue-Gray Gnatcatcher	BGGN	1	Carcass Survey	6/9/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Whole carcass; stiff, feathers downy, flesh present; flesh eaten from head	Unknown	NA	1	11 S 640371 3933380	Heliostat	
2014-284-ISEGS	Lesser Nighthawk	LENI	1	Carcass Survey	6/9/2014	Broken up	3-6 days	tail attached to rump; right, left wing; head present	Unknown	NA	1	11 S 640137 3933360	Heliostat	
2014-285-ISEGS	Chipping Sparrow	CHSP	1	Carcass Survey	6/9/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Whole carcass; eyes desiccated; tissue decayed; slight singeing on left side of nape; feathers falling out and dull	Scorched or singed	3	1	11 S 640375 3933546	ACC Building°	
2014-286-ISEGS	Olive-Sided Flycatcher	OSFL	1	Carcass Survey	6/9/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Whole carcass; singed on head, chest, belly; few wing, tail feathers singed	Scorched or singed	1, 3	1	11 S 640396 3933543	ACC Building°	
2014-287-ISEGS	Horned Lark	HOLA	1	Carcass Survey	6/9/2014	Broken up	7 days	head detached; fluffy feathers; stiff and dry carcass	Unknown	NA	1	11 S 640349 3933264	Heliostat	
2014-288-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/9/2014	Broken up	3-6 days	2 wings; 1 leg; back left of carcass	Unknown	NA	1	11 S 640587 3933397	Heliostat	

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2014-289-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	6/9/2014	Broken up	1 month +	partial carcass - right wing attached; skin missing from skull; desiccated	Unknown	NA	1	11 S 639389 3932903	Heliostat	
2014-290-ISEGS	Anna's Hummingbird	ANHU	1	Carcass Survey	6/9/2014	Dead, fresh (eyes moist)	8-24 hours	Singed leading edge of wing	Scorched or singed	1, 3	1	11 S 640590 3933573	Heliostat	
2014-291-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/10/2014	Feather spot	Unknown	7 flight feathers and a clump of ~15 breast feathers	Unknown	NA	1	11 S 640827 3933252	Heliostat	Changed description from "none" on 10/27/14 (B. Sousa)
2014-292-ISEGS	Unknown	UNKN	1	Carcass Survey	6/10/2014	Broken up	3 weeks	Desiccated; feathers tattered and weathered. Partial carcass consisting of partial right wing, dorsum, and left leg	Unknown	NA	1	11 S 639783 3932717	Heliostat	Corrected time since death from Unknown to 3 weeks on 10/14/14 (B. Sousa)
2014-293-ISEGS	Unknown Sparrow	UNKN	1	Carcass Survey	6/11/2014	Feather spot	3 weeks	2 flight and >60 body feathers. No obvious sign of singeing or collision.	Unknown	NA	1	11 S 639619 3933958	Heliostat	
2014-294-ISEGS	House Finch	HOFI	1	Incidental	6/12/2014	Alive, injured¥	0-8 hours	All flight feathers singed and curled. Singed back feathers. Alert and hopping around.	Scorched or singed	2, 3	1	11 S 640314 3933547	Other	
2014-295-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	6/17/2014	Feather spot	2 weeks	2 clumps of body feathers (10 and 20 respectively)	Unknown	NA	3	11 S 637423 3937711	Heliostat	
2014-296-ISEGS	Townsend's Warbler	TOWA	1	Carcass Survey	6/17/2014	Broken up	3 weeks	Body is desiccated; eyes gone; tail, right wing feathers missing; left wing feathers singed; singed rump, left shoulder, left flank, singed right wing, singed head dorsally. Singeing grade: 2 and 3	Scorched or singed	2, 3	3	11 S 637479 3937955	ACC Building°	
2014-297-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/17/2014	Feather spot	1 month +	3 flight and 15 body feathers	Unknown	NA	3	11 S 637313 3937794	Heliostat	
2014-298-ISEGS	Unknown Swallow	UNKN	1	Carcass Survey	6/17/2014	Feather spot	2 weeks	2 flight, ~5 body feathers; Singeing grade: unknown	Scorched or singed	NA	3	11 S 637287 3937794	Heliostat	
2014-299-ISEGS	Bewick's Wren	BEWR	1	Carcass Survey	6/17/2014	Feather spot	3-6 days	partial left wing, no bones. Also 9 additional primaries, 5 body feathers, 1 tail feather	Unknown	NA	3	11 S 637287 3937795	Heliostat	Changed condition of bird from "broken up" to "feather spot" to add clarity (no bones found) on 10/27/14 (B. Sousa)
2014-300-ISEGS	Yellow Warbler	YEWA	1	Carcass Survey	6/17/2014	Feather spot	1 month +	part of wing; 6 primaries and 5 body feathers	Unknown	NA	3	11 S 637284 3937791	Heliostat	
2014-301-ISEGS	Unknown passerine	UNKN	4	Incidental	6/17/2014	Feather spot	1 month +	~25 body feathers; 3 primaries, 3 secondaries, 3 tail feathers; appears to be 4 individuals	Unknown	NA	3	11 S 636968 3936786	Heliostat	
2014-302-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/17/2014	Broken up	2 days	Partial wing	Unknown	NA	3	11 S 637339 3938090	Heliostat	
2014-303-ISEGS	House Finch	HOFI	1	Carcass Survey	6/17/2014	Dead, fresh (eyes moist)	0-8 hours	soft body; eyes intact; tail/back and right wing curled. Singeing grade: 2 and 3	Scorched or singed	2, 3	3	11 S 637624 3938001	Heliostat	
2014-304-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/18/2014	Broken up	3 weeks	partial carcass and feather spot; Head found with 100 plus body and 20 plus flight feathers	Unknown	NA	3	11 S 636998 3938228	Heliostat	

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2014-305-ISEGS	Eurasian Collared-Dove	EUCD	1	Incidental	6/18/2014	Alive, injured‡	0-8 hours	Both wings singed; rump, tail singed; head, neck singed; Singeing grade 2 and 3.	Scorched or singed	2, 3	1	11 S 640260 3933632	Heliostat	
2014-306-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	6/18/2014	Broken up	1 month +	Desiccated carcass; eyeballs absent; left wing attached; tail feathers present.	Unknown	NA	3	11 S 636690 3939069	Heliostat	
2014-307-ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	6/23/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Carcass desiccated; singeing on throat, breast, head, tail, wing feathers. Singeing grade 2 and 3.	Scorched or singed	2, 3	2	11 S 638649 3935910	ACC Building°	
2014-308-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/23/2014	Broken up	3 weeks	partial carcass and feather spot; skull attached to vertebrae, right leg; right wing attached to keel; tail, wing and body feathers found near carcass parts	Unknown	NA	2	11 S 639105 3936482	Heliostat	Corrected time since death from Unknown to 3 weeks on 10/14/14 (B. Sousa)
2014-309-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	6/26/2014	Feather spot	2 weeks	7 flight feathers; <50 body feathers	Unknown	NA	2	11 S 638712 3937175	Heliostat	
2014-310-ISEGS	Mourning Dove	MODO	1	Carcass Survey	6/26/2014	Feather spot	1 month +	7 wing feathers, 22 body feathers	Unknown	NA	NA	11 S 639718 3934994	Fencing	
2014-311-ISEGS	Horned Lark	HOLA	1	Carcass Survey	6/26/2014	Feather spot	1 month +	3 primary flight feathers attached to bone, 2 separate flight feathers	Unknown	NA	NA	11 S 639714 3934990	Fencing	
2014-312-ISEGS	Yellow-headed Blackbird	YHBL	1	Carcass Survey	6/26/2014	Feather spot	2 weeks	10 plus flight, covert feathers; 5 body feathers	Unknown	NA	NA	11 S 639640 3934944	Fencing	
2014-313-ISEGS	House Finch	HOFI	1	Carcass Survey	6/30/2014	Mummified	2 weeks	Body desiccated; both wings and tail feathers curled(dorsal, back, head singed) Singeing grade 2 and 3.	Scorched or singed	2, 3	1	11 S 640372 3933530	ACC Building°	
2014-314-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	6/30/2014	Feather spot	7 days	partial right wing; 10 + body feathers	Unknown	NA	1	11 S 639432 3932827	Heliostat	
2014-315-ISEGS	Common Gallinule	COGA	1	Incidental	6/30/2014	Broken up	3 weeks	Right wing only; feathers stiff and brittle; weathered	Unknown	NA	1	11 S 639955 3932929	Heliostat	
2014-316-ISEGS	Black-Throated Sparrow	BTSP	1	Incidental	7/1/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Skull was clear of feathers; carcass dry and sluffing feathers. Feathers not faded. Carcass was covered in ants when found.	Collision with solar panel/heliostat	NA	1	11 S 640709 3932810	Heliostat	
2014-317-ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	7/8/2014	Mummified	2 weeks	wing/tail feathers singed; coverts and rump feathers singed. Singeing grade 2 and 3	Scorched or singed	2, 3	3	11 S 637492 3938005	ACC Building	
2014-318-ISEGS	Horned Lark	HOLA	1	Carcass Survey	7/8/2014	Dead, fresh (eyes moist)	2 days	whole carcass; eyes still present; feathers bright and clean; being scavenged by ants	Unknown	NA	3	11 S 637246 3937874	Heliostat	
2014-319-ISEGS	Greater Roadrunner	GRRO	1	Carcass Survey	7/8/2014	Broken up	3-6 days	Right wing complete; 30 body feathers; upper, lower bill	Unknown	NA	3	11 S 637705 3938000	Heliostat	
2014-320-ISEGS	Unknown Hummingbird	UNKN	1	Carcass Survey	7/8/2014	Mummified	3 weeks	Almost all feathers burnt off; entire body burnt. Singeing grade 2 and 3.	Scorched or singed	2, 3	3	11 S 637485 3937919	Solar Concentrating Tower	Filled in blank distance and azimuth to Project feather on 10/27/14 (B. Sousa)

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2014-321-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	7/9/2014	Broken up	1 month +	detached leg with skin and feathers attached at top	Unknown	NA	3	11 S 636921 3937006	Heliostat	Corrected time since death from Unknown to 1 month+ 10/14/14 (B. Sousa). Corrected GPS coordinate, distance, and direction to nearest structure on 10/25/14 (B. Sousa)
2014-322-ISEGS	Mourning Dove	MODO	1	Incidental	7/9/2014	Broken up	Unknown	bones - vertebral column, keel, scapulas and one leg with foot	Unknown	NA	2	11 S 638626 3935127	Heliostat	
2014-323-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	7/10/2014	Articulated skeletal	1 month +	skeletal remains; keel, vertebral column, wing bones; no flesh, no feathers	Unknown	NA	3	11 S 636450 3936770	Heliostat	
2014-324-ISEGS	Mourning Dove	MODO	1	Carcass Survey	7/10/2014	Broken up	1 month +	2 wings; <5 body feathers	Unknown	NA	3	11 S 636541 3936939	Heliostat	
2014-325-ISEGS	Cliff Swallow	CLSW	1	Incidental	7/10/2014	Mummified	1 month +	desiccated; eyes gone; rigor mortis; single primary feather on left wing and top of head singed. Singeing grade 1.	Scorched or singed	1	3	11 S 637468 3937890	Solar Concentrating Tower	
2014-326-ISEGS	Scott's Oriole	SCOR	1	Carcass Survey	7/10/2014	Dead, fresh (eyes moist)	8-24 hours	Very fresh pliable carcass; no visible external trauma; possible mirror strike, found lying directly underneath heliostat	Collision with solar panel/heliostat	NA	3	11 S 636986 3936725	Heliostat	
2014-327-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	7/10/2014	Broken up	2 weeks	partial carcass and feather spot; wing, tail, body feathers and wing and leg bone found	Unknown	NA	3	11 S 636876 3936727	Heliostat	Changed bird condition from "feather spot" to "broken up" and updated carcass condition to add clarity regarding feather spot on 10/25/14 (B. Sousa)
2014-328-ISEGS	Greater Roadrunner	GRRO	1	Incidental		Feather spot	3-6 days	primary, coverts and body feathers found along road near Unit 2 fence	Unknown	NA	2	11 S 639681 3935318	Fencing	
2014-329-ISEGS	Mourning Dove	MODO	1	Carcass Survey	7/11/2014	Broken up	1 month +	dry, desiccated wing	Unknown	NA	3	11 S 638607 3937823	Heliostat	
2014-330-ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	7/14/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Singed tail/wing feathers, singed coverts, head and upper back. Singeing grade 2 and 3.	Scorched or singed	2, 3	2	11 S 638696 3935929	ACC Building°	
2014-331-ISEGS	Cliff Swallow	CLSW	1	Carcass Survey	7/14/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Tail feathers missing, flight/wing feathers completely singed* Singeing grade 2 and 3.	Scorched or singed	2, 3	2	11 S 638699 3935910	ACC Building°	
2014-332-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	7/15/2014	Broken up	3 weeks	Partial wing	Unknown	NA	2	11 S 638872 3935472	Heliostat	

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2014-333-ISEGS	Mourning Dove	MODO	1	Incidental	7/16/2014	Broken up	1 month +	partial wing	Unknown	NA	2	11 S 639099 3936484	Heliostat	
2014-334-ISEGS	Loggerhead Shrike	LOSH	1	Carcass Survey	7/16/2014	Broken up	1 month +	Partial carcass and feather spot; 10+ flight feathers, 50+ body feathers, lower mandible, some wing bones. All heavily weathered and bleached - feather spot much older than 1 month	Unknown	NA	2	11 S 639484 3936936	Heliostat	Changed condition of carcass from feather spot to broken up; added clarity regarding feather spot on 10/27/14 (B. Sousa)
2014-335-ISEGS	Tree Swallow	TRES	1	Carcass Survey	7/21/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	tail and wing feathers singed; singed dorsal feathers	Scorched or singed	2, 3	1	11 S 640425 3933527	ACC Building°	
2014-336-ISEGS	Tree Swallow	TRES	1	Carcass Survey	7/21/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	tail and wing feathers singed, rump singed, singed on both cheeks	Scorched or singed	2, 3	1	11 S 640369 3933531	ACC Building°	
2014-337-ISEGS	Bank Swallow	BANS	1	Carcass Survey	7/21/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	singed flight and body feathers	Scorched or singed	2, 3	1	11 S 640371 3933534	ACC Building°	
2014-338-ISEGS	Tree Swallow	TRES	1	Carcass Survey	7/21/2014	Feather spot	7 days	10 singed primaries; 3 singed retrices; 20+ contour feathers, some singed	Scorched or singed	NA	1	11 S 640499 3933486	Heliostat	Corrected carcass condition typo from dead, fresh to feather spot on 10/14/14 (B. Sousa)
2014-339-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	7/21/2014	Dead, fresh (eyes moist)	0-8 hours	whole carcass- Nearly all flight and dorsal body feathers singed. Face and head singed.	Scorched or singed	2, 3	1	11 S 640327 3933480	Project Building	
2014-340-ISEGS	Cactus Wren	CACW	1	Carcass Survey	7/21/2014	Broken up	3 weeks	partial L wing, no obvious injuries	Unknown	NA	1	11 S 640145 3932703	Heliostat	
2014-341-ISEGS	Lesser Nighthawk	LENI	1	Incidental	7/22/2014	Broken up	0-8 hours	partial carcass - both wings attached to body; missing brains and part of head (bill is present); tail feathers detached from body; some flesh on dorsal side appears to be missing	Unknown	NA	NA	11 S 642049 3934985	Other	
2014-342-ISEGS	Black-Throated Sparrow	BTSP	1	Incidental	7/28/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	No external trauma present; no singeing	Collision (other)	NA	3	11 S 637471 3937900	Solar Concentrating Tower	Corrected time since death from 8-24 hours to 7 days and GPS coordinate on 10/14/14 (B. Sousa)
2014-343-ISEGS	Northern Rough-winged Swallow	NRWS	1	Carcass Survey	7/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	All flight feathers singed and curled. Head, back and rump singed.	Scorched or singed	2, 3	3	11 S 637471 3937955	ACC Building°	

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2014-344-ISEGS	Unknown Hummingbird	UNKN	1	Carcass Survey	7/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Tail missing, rump singed black. Singed head and back of neck.	Scorched or singed	1, 3	3	11 S 637507 3937979	ACC Building°	
2014-345-ISEGS	American Kestrel	AMKE	1	Carcass Survey	7/29/2014	Feather spot	3-6 days	No damage or singeing observed. 2 primaries, 3 clumps containing a total of 5 secondaries and 5+ coverts, 10+ body feathers	Unknown	NA	3	11 S 637724 3937855	Heliostat	
2014-346-ISEGS	Tree Swallow	TRES	1	Carcass Survey	7/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	All flight feathers singed; singed face and rump	Scorched or singed	2, 3	3	11 S 637525 3937966	ACC Building°	
2014-347-ISEGS	Verdin	VERD	1	Carcass Survey	7/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	No external trauma present; no singeing	Other	NA	3	11 S 637476 3937971	ACC Building°	
2014-348-ISEGS	Unknown passerine	UNKN	1	Carcass Survey	7/29/2014	Feather spot	3 weeks	~6 flight and 5 body feathers. No damage or singeing observed.	Unknown	NA	3	11 S 636923 3937003	Heliostat	
2014-349-ISEGS	Unknown Passerine/Swift	UNKN	1	Carcass Survey	7/29/2014	Feather spot	7 days	No damage or singeing observed. 20-30 body feathers.	Unknown	NA	3	11 S 637522 3937925	Auxiliary Boiler	
2014-350-ISEGS	House Finch	HOFI	1	Carcass Survey	7/29/2014	Broken up	2 weeks	No damage or singeing observed. Both wings, 5 flight and 20 body feathers.	Unknown	NA	3	11 S 637431 3937895	Project Building	Added clarity regarding feather spot on 10/27/14 (B. Sousa)
2014-351-ISEGS	Tree Swallow	TRES	1	Incidental	7/30/2014	Dead, fresh (eyes moist)	0-8 hours	Singed flight feathers and chest. Singeing grade 2 and 3	Scorched or singed	2, 3	1	11 S 640318 3933445	Road	
2014-352-ISEGS	House Finch	HOFI	1	Incidental	7/30/2014	Dead, fresh (eyes moist)	0-8 hours	Entire body singed	Scorched or singed	2, 3	1	11 S 640408 3933493	Auxilary Boiler	
2014-353-ISEGS	Black-Throated Sparrow	BTSP	1	Incidental	7/31/2014	Alive, injured†	0-8 hours	No external trauma evident; no singeing of feathers; normal feather wear present; initially found lying on back; could move short distance by hopping; was vocal and eyes were alert; when placed in carrying box laid on side and stomach; probably internal and/or head injury	Collision with solar panel/heliostat	NA	1	11 S 640954 3933292	Heliostat	
2014-354-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	7/31/2014	Broken up	3-6 days	Feather spot and bone fragments; 4 primaries; 3 tail, and 30 body feathers; small bits of bone	Unknown	NA	3	11 S 636937 3936767	Heliostat	Changed carcass condition from feather spot to broken up on 10/27/14 (B. Sousa)
2014-355-ISEGS	Mourning Dove	MODO	1	Incidental	7/31/2014	Broken up	1 month +	exposed bones, some feathers very weathered	Unknown	NA	3	11 S 636799 3936811	Heliostat	

USFWS #	Common Name	Species Code[1]	Number Individuals	How Found	Collection Date	Bird/Carcass Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury /Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014-356-ISEGS	Black-Throated Sparrow	BTSP	1	Incidental	7/31/2014	Dead, fresh (eyes moist)	8-24 hours	Singeing on right side of neck; singeing and curled tail feathers. Singeing grade 1	Scorched or singed	1	3	11 S 637427 3937920	Project Building	
2014-357-ISEGS	Greater Roadrunner	GRRO	1	Carcass Survey	8/1/2014	Feather spot	2 weeks	3 wing feathers, 3 body feathers (weathered); no singeing evident	Unknown	NA	3	11 S 638921 3937888	Heliostat	
2014-358-ISEGS	Black-Throated Sparrow	BTSP	1	Incidental	8/1/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass - head feathers and eye sockets starting to be eaten by insects; carcass still pliable	Collision with solar panel/heliostat	NA	3	11 S 637046 3938586	Heliostat	
2014-359-ISEGS	Verdin	VERD	1	Carcass Survey	8/4/2014	Dead, fresh (eyes moist)	7 days	Carcass wet; no singeing or external trauma evident; checked under scope	Other	NA	2	11 S 638656 3935914	ACC Building°	
2014-360-ISEGS	Northern Rough-winged Swallow	NRWS	1	Carcass Survey	8/4/2014	Broken up	3 weeks	2 wings, 2 legs; singeing on primaries and secondaries; Singeing grade: unknown	Scorched or singed	Unkn own	2	11 S 638701 3935828	Power block	Added clarity regarding feather spot and changed time since death from "unknown" to "3 weeks" after review of photographs on 10/27/14 (B. Sousa)
2014-361-ISEGS	Lesser Nighthawk	LENI	1	Carcass Survey	8/4/2014	Broken up	7 days	20+ flight feathers, 50+ body feathers; part of left and right wing, tail feathers; skull pieces, some small bones; no evidence of singeing, checked under scope	Unknown	NA	2	11 S 639502 3936675	Heliostat	Added clarity regarding feather spot on 10/27/14 (B. Sousa)
2014-362-ISEGS	Rock Pigeon	ROPI	1	Incidental	8/5/2014	Broken up	8-24 hours	whole carcass minus head. No evidence of singeing, checked under scope. Blue band on right leg reads: May 2014, 14029, GEM, Las Vegas, NV	Unknown	NA	1	11 S 640303 3933572	Power block	
2014-363-ISEGS	Lesser Nighthawk	LENI	1	Carcass Survey	8/6/2014	Feather spot	2 weeks	12 flight feathers; ~40 body feathers; feathers matted, weathered; no singeing evident, checked under scope.	Unknown	NA	2	11 S 639489 3936546	Heliostat	
2014-364-ISEGS	Hermit Warbler	HEWA	1	Incidental	8/7/2014	Dead, fresh (eyes moist)	0-8 hours	whole carcass; eyes still moist; broken left wing	Collision (other)		NA	11 S 640428 3935340	Tortoise Fence	Filled in alpha code on10/27/14 (B. Sousa)
2014-365-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	8/11/2014	Mummified	7 days	Whole carcass: retrices curled and charred; body burned; eyes sunken. Singeing grade 2 and 3	Scorched or singed	1	1	11 S 640374 3933543	ACC Building°	Corrected time since death from 8-24 hours to 7 days on 10/14/14 (B. Sousa)
2014-366-ISEGS	Rufous Hummingbird	RUHU	1	Carcass Survey	8/11/2014	Mummified	3-6 days	Whole carcass: Burns on head, body and tail feathers. Singeing grade 1 and 3	Scorched or singed	1, 3	1	11 S 640402 3933537	ACC Building°	
2014-367-ISEGS	Yellow-rumped Warbler	YRWA	1	Carcass Survey	8/11/2014	Mummified	2 weeks	Whole carcass: Singeing and burns on most of body. Singeing grade 1 and 3.	Scorched or singed	1, 3	1	11 S 640378 3933523	ACC Building°	Corrected certainty from Probable to Valid on 10/14/14 (B. Sousa).

USFWS #	Common Name	Species Code[1]	Number Individuals	How Found	Collection Date	Bird/Carcass Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury /Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014-368-ISEGS	Lesser Nighthawk	LENI	1	Carcass Survey	8/11/2014	Broken up	0-8 hours	wing, part of body, feathers caught in fan guard (partial carcass non-retrievable); was able to retrieve a few body feathers (not singed; checked under scope); unable to determine if non-retrievable parts were singed or not	Collision (other)		1	11 S 640396 3933523	ACC Building°	
2014-369-ISEGS	Black-Throated Sparrow	BTSP	1	Carcass Survey	8/11/2014	Feather spot	3-6 days	13 flight feathers and 4 body feathers. Charring and singeing present on tail feathers.	Scorched or singed	NA	1	11 S 640310 3933661	Heliostat	
2014-370-ISEGS	Phainopepla	PHAI	1	Carcass Survey	8/12/2014	Dead, fresh (eyes moist)	2 days	Whole carcass: no visible trauma; no singeing evident (checked under scope)	Unknown	NA	1	11 S 639872 3933364	Heliostat	
2014-371-ISEGS	Yellow Warbler	YEWA	1	Incidental	8/13/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass minu tail: singeing present on tips of all wing feathers, back and head; found adjacent to support pylon of tower, possible collision as well	Scorched or singed	2, 3	2	11 S 638669 3935851	Solar Concentrating Tower	
2014-372-ISEGS	Lesser Nighthawk	LENI	1	Incidental	8/13/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass: no evidence of singeing (checked under scope); red ants present on breast; skull partially exposed	Collision (other)	NA	NA	11 S 639778 3934717	Project Building	
2014-373-ISEGS	Unknown	UNKN	1	Carcass Survey	8/13/2014	Broken up	Unknown	Skeletal remains with foot and tail of unknown bird	Unknown	Unknown	1	11 S 640991 3932929	Heliostat	
2014-b09-ISEGS	California Myotis	MYCA	1	Carcass Survey	6/2/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass	Unknown	NA	2	11 S 638623 3935903	ACC Building°	Corrected time since death from blank to 3-6 days; moved GPS point to correct position within ACC building on 10/14/14 (B. Sousa)
2014-b10-ISEGS	California Myotis	MYCA	1	Carcass Survey	6/30/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Whole carcass	Unknown	NA	1	11 S 640378 3933542	ACC Building°	Moved GPS point to correct position within ACC building on 10/14/14 (B. Sousa).
2014-B11-ISEGS	Western Small-footed Bat	MYCI	1	Carcass Survey	7/8/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Whole carcass; laceration wound on lower back, piece of skin/flesh detached;	Collision (other)	NA	3	11 S 637452 3937982	ACC Building°	
2014-B12-ISEGS	California Myotis	MYCA	1	Carcass Survey	7/8/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Whole carcass; laceration wound on ventral side near left wing	Collision (other)	NA	3	11 S 637481 3937981	ACC Building°	

USFWS #	Common Name	Species Code[1]	Number Individuals	How Found	Collection Date	Bird/Carcass Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Injury /Mortality[2]	Burn Grade	Unit	UTM Coordinates[3]	Nearest Project Feature	SPUT Revisions[4]
2014-B13-ISEGS	California Myotis	MYCA	1	Carcass Survey	7/8/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	3 weeks	Whole carcass; two holes in right side of abdomen	Unknown	NA	3	11 S 637462 3937960	ACC Building°	
2014-B14-ISEGS	Canyon Bat	PAHE	1	Carcass Survey	7/29/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Whole carcass; laceration on abdomen; no singeing	Collision (other)	NA	3	11 S 637513 3937945	ACC Building°	Moved GPS point to correct position within ACC building on 10/14/14 (B. Sousa)
2014-B15-ISEGS	Canyon Bat	PAHE	1	Incidental	7/29/2014	Alive, sick*	0-8 hours	Found on road, not flying far. No obvious injuries seen.	Other	NA	2	11 S 638680 3935911	ACC Building	Corrected Unit from 3 to 2 on 10/13/14 (B. Sousa).
2014-b16-ISEGS	Mexican Free-tailed Bat	TABR	1	Incidental	8/1/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass; no singeing evident; carcass was ran over by vehicle before it was collected.	Unknown	NA	2	11 S 638628 3935823	Power block parking lot	
2014-b17-ISEGS	Canyon Bat	PAHE	1	Carcass Survey	8/4/2014	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Whole carcass; desiccated; no singeing evident; checked under scope	Unknown	NA	2	11 S 638689 3935912	ACC Building°	
2014-B18-ISEGS	Canyon Bat	PAHE	1	Carcass Survey	8/11/2014	Dead, fresh (eyes moist)	3-6 days	Whole carcass; broken forearm bone evident; no sign of singeing (checked under scope)	Collision (other)		1	11 S 640400 3933524	ACC Building°	
2014-B19-ISEGS	California Myotis	MYCA	1	Carcass Survey	8/11/2014	Dead, fresh (eyes moist)	7 days	Whole carcass: lacerations and broken bones indicative of collision with fan	Collision (other)	NA	1	11 S 640399 3933534	ACC Building°	
2014-B20-ISEGS	Unknown Myotis	MYSP	1	Carcass Survey	8/11/2014	Dead, fresh (eyes moist)	8-24 hours	Whole carcass: facial damage (face was smashed); tissue damage (membrane torn); no sign of singeing (checked under scope)	Collision (other)		1	11 S 640361 3933541	ACC Building°	

[1] Alpha codes are defined in Table 1.

[2] "Unknown" cause of death = no evidence of singeing and no clear evidence of what caused the fatality; "Singed" = evidence of singeing on the carcass or feather spot; "Collision" = evidence of collision was observed, such as a bird-strike imprint and/or feathers on a heliostat above the detection; "Other" = a detection with a known cause without signs of collision or singeing (in summer 2014, all "other" detections were of birds found in the ACC units).
Where sufficient information was available for earlier detections, singed carcass detections were assigned a singeing grade based on Kagan et al. (2014), as follows:

- Grade 1 – curling of less than 50% of the flight feathers
- Grade 2 – curling of 50% or more of the flight feathers
- Grade 3 – curling and visible charring of contour feathers

Grades were not applied in the case of feather spots or partial carcasses.

[3] UTM = Universal Transverse Mercator coordinate system

[4] This column indicates changes that were made after the initial SPUT database entry

* Released alive.
‡ Euthanized on site per OLE instructions.
¥ Died at rehabilitation facility.
† Died on site.
° Found inside ACC building.

Appendix B. Additional Detection Data for Fatality Estimates and Documentation of Fatality Estimates in Which Each Detection Was Included.

Variables for Fatality Estimator									Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Carcass Size	Feather Spot Size	Model Category	Cause of Death[2]	Incidental	Time Since Last Survey (days)[3]	Used in Estimator[4]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[5]
2014-262-ISEGS	Inner HD	140	Large	small	Feather Spot	Unknown	No	23	X	X				X	
2014-263-ISEGS	Power Block*	70	Small		Carcass	Singeing	No	23					X		
2014-264-ISEGS	Power Block*	60	Small		Carcass	Singeing	No	23					X		
2014-265-ISEGS	Power Block*	53	Small		Carcass	Singeing	No	23					X		
2014-266-ISEGS	Power Block*	40	Small		Carcass	Singeing	No	23					X		
2014-267-ISEGS	Inner HD	130	Small		Carcass	Collision	No	23	X	X				X	
2014-268-ISEGS	Power Block	88	Small	small	Feather Spot	Unknown	No	23	X	X		X			
2014-269-ISEGS	Unit Fence	1060	Large	large	Feather Spot	Unknown	No	23							No fence estimate
2014-270-ISEGS	Unit Fence	1370	Large	small	Feather Spot	Unknown	No	23							No fence estimate
2014-271-ISEGS	Inner Segment	280	Small		Carcass	Unknown	No	22	X		X				
2014-272-ISEGS	Power Block	35	Small		Carcass	Unknown	Yes	16	X	X		X			
2014-273-ISEGS	Outer Segment	1110	Large	large	Feather Spot	Collision	No	22	X		X				
2014-274-ISEGS	Power Block	80	Small		Carcass	Singeing	Yes	1	X	X		X			
2014-275-ISEGS	Inner HD	200	unknown	small	Feather Spot	Unknown	No	20						X	Unknown carcass size, added unadjusted
2014-276-ISEGS	Inner HD	190	Small		Carcass	Singeing	No	20	X	X				X	
2014-277-ISEGS	Power Block*	88	Small		Carcass	Singeing	No	20					X		
2014-278-ISEGS	Power Block	34	Small		Carcass	Singeing	No	20	X	X		X			
2014-279-ISEGS	Power Block	1	Small		Carcass	Singeing	No	20	X	X		X			
2014-280-ISEGS	Inner Segment	440	Small	small	Feather Spot	Unknown	No	20	X		X				
2014-281-ISEGS	Outer Segment	800	Large		Carcass	Unknown	No	20	X		X				
2014-282-ISEGS	Power Block	30	Small		Carcass	Singeing	Yes	18	X	X		X			
2014-283-ISEGS	Inner HD	79	Small		Carcass	Unknown	No	21	X	X				X	
2014-284-ISEGS	Inner HD	260	Small		Carcass	Unknown	No	21	X	X				X	
2014-285-ISEGS	Power Block*	80	Small		Carcass	Singeing	No	21					X		
2014-286-ISEGS	Power Block*	87	Small		Carcass	Singeing	No	21					X		
2014-287-ISEGS	Inner HD	200	Small		Carcass	Unknown	No	21	X	X				X	
2014-288-ISEGS	Inner HD	220	Large		Carcass	Unknown	No	21	X	X				X	
2014-289-ISEGS	Outer Segment	1130	Small		Carcass	Unknown	No	19							Older than interval
2014-290-ISEGS	Inner HD	240	Small		Carcass	Singeing	No	21	X	X				X	
2014-291-ISEGS	Inner Segment	490	Large	small	Feather Spot	Unknown	No	20	X		X				
2014-292-ISEGS	Outer Segment	940	Small		Carcass	Unknown	No	20	X		X				
2014-293-ISEGS	Outer Segment	910	Small	small	Feather	Unknown	No	21	X		X				

		Variables for Fatality Estimator							Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Carcass Size	Feather Spot Size	Model Category	Cause of Death[2]	Incidental	Time Since Last Survey (days)[3]	Used in Estimator[4]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[5]
					Spot										
2014-294-ISEGS	Power Block	105	Small		Carcass	Singeing	Yes	3	X	X		X			
2014-295-ISEGS	Inner HD	200	Small	small	Feather Spot	Unknown	No	20	X	X				X	
2014-296-ISEGS	Power Block*	50	Small		Carcass	Singeing	No	20					X		
2014-297-ISEGS	Inner HD	190	Large	small	Feather Spot	Unknown	No	20							Older than interval
2014-298-ISEGS	Inner HD	210	Small	small	Feather Spot	Singeing	No	20	X	X				X	
2014-299-ISEGS	Inner HD	210	Small	small	Feather Spot	Unknown	No	20	X	X				X	
2014-300-ISEGS	Inner HD	220	Small	small	Feather Spot	Unknown	No	20							Older than interval
2014-301-ISEGS	Outer Segment‡	1230	Small	small	Feather Spot	Unknown	Yes								Older than interval
2014-301-ISEGS	Outer Segment‡	1230	Small	small	Feather Spot	Unknown	Yes								Older than interval
2014-301-ISEGS	Outer Segment‡	1230	Small	small	Feather Spot	Unknown	Yes								Older than interval
2014-301-ISEGS	Outer Segment‡	1230	Small	small	Feather Spot	Unknown	Yes								Older than interval
2014-302-ISEGS	Inner HD	230	Large		Carcass	Unknown	No	20	X	X				X	
2014-303-ISEGS	Inner HD	180	Small		Carcass	Singeing	No	20	X	X				X	
2014-304-ISEGS	Inner Segment	570	Large	large	Feather Spot	Unknown	No	21	X		X				
2014-305-ISEGS	Inner HD	210	Large		Carcass	Singeing	Yes	8	X	X				X	
2014-306-ISEGS	Outer Segment	1400	Small		Carcass	Unknown	No	20							Older than interval
2014-307-ISEGS	Power Block*	82	Small		Carcass	Singeing	No	21					X		
2014-308-ISEGS	Outer Segment	790	Large	large	Feather Spot	Unknown	No	18	X		X				
2014-309-ISEGS	Outer Segment	1360	Small	large	Feather Spot	Unknown	No	21	X		X				
2014-310-ISEGS	CLA Fence		Large	large	Feather Spot	Unknown	No	21							Older than interval
2014-311-ISEGS	CLA Fence		Small	small	Feather Spot	Unknown	No	21							Older than interval
2014-312-ISEGS	CLA Fence		Small	small	Feather Spot	Unknown	No	21							No fence estimate
2014-313-ISEGS	Power Block*	70	Small		Carcass	Singeing	No	21					X		
2014-314-ISEGS	Outer Segment	1131	Small	small	Feather Spot	Unknown	No	21	X		X				
2014-315-ISEGS	Outer Segment‡	680	Large		Carcass	Unknown	Yes								Outside of survey area
2014-316-ISEGS	Outer Segment	730	Small		Carcass	Collision	Yes	19	X		X				
2014-317-ISEGS	Power Block	103	Small		Carcass	Singeing	No	21	X	X		X			
2014-318-ISEGS	Inner HD	220	Small		Carcass	Unknown	No	21	X	X				X	
2014-319-ISEGS	Inner HD	270	Large		Carcass	Unknown	No	21	X	X				X	

Variables for Fatality Estimator									Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Carcass Size	Feather Spot Size	Model Category	Cause of Death[2]	Incidental	Time Since Last Survey (days)[3]	Used in Estimator[4]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[5]
2014-320-ISEGS	Power Block	0	Small		Carcass	Singeing	No	21	X	X		X			
2014-321-ISEGS	Outer Segment	1100	Small		Carcass	Unknown	No	19							Older than interval
2014-322-ISEGS	Outer Segment‡	710	Large		Carcass	Unknown	Yes								Outside of survey area
2014-323-ISEGS	Outer Segment	1530	Small		Carcass	Unknown	No	21							Older than interval
2014-324-ISEGS	Outer Segment	1350	Large		Carcass	Unknown	No	21							Older than interval
2014-325-ISEGS	Power Block	0	Small		Carcass	Singeing	Yes	23							Older than interval
2014-326-ISEGS	Outer Segment	1270	Small		Carcass	Collision	No	23	X		X				
2014-327-ISEGS	Outer Segment	1320	Small	large	Feather Spot	Unknown	No	23	X		X				
2014-328-ISEGS	Unit Fence	1150	Large	small	Feather Spot	Unknown	Yes	16							No fence estimate
2014-329-ISEGS	Outer Segment	1114	Large		Carcass	Unknown	No	21							Older than interval
2014-330-ISEGS	Power Block*	87	Small		Carcass	Singeing	No	21					X		
2014-331-ISEGS	Power Block*	96	Small		Carcass	Singeing	No	21					X		
2014-332-ISEGS	Inner Segment	420	Small		Carcass	Unknown	No	21	X		X				
2014-333-ISEGS	Outer Segment‡	790	Large		Carcass	Unknown	Yes								Older than interval
2014-334-ISEGS	Outer Segment	1390	Small	small	Feather Spot	Unknown	No	20							Older than interval
2014-335-ISEGS	Power Block*	82	Small		Carcass	Singeing	No	21					X		
2014-336-ISEGS	Power Block*	64	Small		Carcass	Singeing	No	21					X		
2014-337-ISEGS	Power Block*	67	Small		Carcass	Singeing	No	21					X		
2014-338-ISEGS	Inner HD	110	Small	large	Feather Spot	Singeing	No	21	X	X				X	
2014-339-ISEGS	Power Block	50	Small		Carcass	Singeing	No	21	X	X		X			
2014-340-ISEGS	Outer Segment	790	Small		Carcass	Unknown	No	21	X		X				
2014-341-ISEGS	Other Project Lands‡		Small		Carcass	Unknown	Yes								Outside of survey area
2014-342-ISEGS	Power Block‡	0	Small		Carcass	Collision	Yes		X	X		X			
2014-343-ISEGS	Power Block*	42	Small		Carcass	Singeing	No	21					X		
2014-344-ISEGS	Power Block*	71	Small		Carcass	Singeing	No	21					X		
2014-345-ISEGS	Inner HD	250	Raptor	small	Feather Spot	Unknown	No	21	X	X				X	
2014-346-ISEGS	Power Block*	80	Small		Carcass	Singeing	No	21					X		
2014-347-ISEGS	Power Block*	75	Small		Carcass	Other	No	21					X		
2014-348-ISEGS	Outer Segment	1060	Small	small	Feather Spot	Unknown	No	21	X		X				
2014-349-ISEGS	Power Block	54	Small	small	Feather Spot	Unknown	No	21	X	X		X			
2014-350-ISEGS	Power Block	41	Small		Carcass	Unknown	No	21	X	X		X			
2014-351-ISEGS	Power Block	15	Small		Carcass	Singeing	Yes	9	X	X		X			

		Variables for Fatality Estimator							Fatality Estimates in Which Each Detection was Included						
FWS #[1]	Location	Distance from Tower (m)	Carcass Size	Feather Spot Size	Model Category	Cause of Death[2]	Incidental	Time Since Last Survey (days)[3]	Used in Estimator[4]	Tower Area	Heliostat Area	Power Block	ACC Building	Inner HD	Estimator Notes[5]
2014-352-ISEGS	Power Block	8	Small		Carcass	Singeing	Yes	9	X	X		X			
2014-353-ISEGS	Outer Segment‡	634	Small		Carcass	Collision	Yes								Outside of survey area
2014-354-ISEGS	Outer Segment	1247	Small	small	Feather Spot	Unknown	No	21	X		X				
2014-355-ISEGS	Outer Segment‡	1267	Large		Carcass	Unknown	Yes								Outside of survey area
2014-356-ISEGS	Power Block	30	Small		Carcass	Singeing	Yes	2	X	X		X			
2014-357-ISEGS	Outer Segment	1440	Large	small	Feather Spot	Unknown	No	21	X		X				
2014-358-ISEGS	Outer Segment‡	790	Small		Carcass	Collision	Yes								Outside of survey area
2014-359-ISEGS	Power Block*	72	Small		Carcass	Other	No	21					X		
2014-360-ISEGS	Power Block	57	Small		Carcass	Singeing	No	21	X	X		X			
2014-361-ISEGS	Outer Segment	1200	Small		Carcass	Unknown	No	21	X		X				
2014-362-ISEGS	Power Block	120	Large		Carcass	Unknown	Yes	15	X	X					
2014-363-ISEGS	Outer Segment	1110	Small	small	Feather Spot	Unknown	No	21	X		X				
2014-364-ISEGS	Other Project Lands‡		Small		Carcass	Collision	Yes								Outside of survey area
2014-365-ISEGS	Power Block*	83	Small		Carcass	Singeing	No	21					X		
2014-366-ISEGS	Power Block*	86	Small		Carcass	Singeing	No	21					X		
2014-367-ISEGS	Power Block*	62	Small		Carcass	Singeing	No	21					X		
2014-368-ISEGS	Power Block*	77	Small		Carcass	Collision	No	21					X		
2014-369-ISEGS	Inner HD	210	Small	small	Feather Spot	Singeing	No	21	X	X				X	
2014-370-ISEGS	Inner Segment	510	Small		Carcass	Unknown	No	21	X		X				
2014-371-ISEGS	Power Block	33	Small		Carcass	Singeing	Yes	9	X	X		X			
2014-372-ISEGS	Other Project Lands‡		Small		Carcass	Collision	Yes								Outside of survey area
2014-373-ISEGS	Outer Segment	810	Small		Carcass	Unknown	No	21							Older than interval

[1] The FWS # can be used to match each detection in Appendix B with additional information provided in Appendix A.

[2] "Unknown" cause of death = no evidence of singeing and no clear evidence of what caused the fatality; "Singeing" = evidence of singeing on the carcass or feather spot; "Collision" = evidence of collision was observed, such as a bird-strike imprint and/or feathers on a heliostat above the detection; "Other" = a detection with known cause without signs of collision or singeing (in summer 2014, all "other" detections were of birds found in the ACC units).

[3] "Time Since Last Survey" indicates the number of days between when the detection was found and the previous standardized survey of the area in which it was found.

[4] "Used in Estimator" indicates whether the detection was used in the fatality estimates. If it was not, the "Estimator Notes" column indicates why not. If it was, an "X" appears under one or more of the subsequent five columns to indicate whether the detection was used in the fatality estimate for the "Tower Area" (consisting of the power block plus inner HD heliostats combined), "Heliostat Area" (consisting of the inner and outer heliostat segments), "Power Block", "ACC", or , "Inner HD" areas. Note that because the ACC building (which is located within the Power Block) is a closed system, being only marginally accessible to scavengers, no fatality estimate per se was made for the ACC buildings; rather, the detections in the ACC buildings were added to the estimates for the Power Block and Tower Area after the fatality estimator was used to produce estimates for those areas.

[5] "Outside of survey area" indicates that the detection was not within the standardized survey areas and thus were not appropriate for inclusion in the fatality estimator. Similarly, detections that were "older than search interval", indicating that the carcasses were deemed to have been present longer than the "time since last survey", are not included in the fatality estimator.

* Found in ACC building.

‡ Found outside of surveyed areas.

Note: Fatalities in ACC building and along fences were not used in the fatality estimator, but were added in to fatality estimates totals.