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IVANPAH SOLAR ELECTRIC GENERATING SYSTEM
AVIAN & BAT MONITORING PLAN

2015 SPRING REPORT

Prepared for:

Solar Partners I, II, and VIII

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Executive Summary

Avian and bat monitoring surveys were conducted from 16 March, 2015 to 24 May 2015 (the spring 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 persistence trials were conducted. This report represents the second "quarterly" (i.e., seasonal) report for the second year of monitoring (or sixth overall quarterly report). Western EcoSystems Technology (WEST) Inc. performed 100% of the monitoring effort for the 2015 spring season.

During avian point count surveys, a total of 41 bird species were recorded. Species richness was highest on the lower desert bajada grid (25 species), slightly lower on the upper desert bajada grid (22 species), and lowest in the three heliostat grids (14 species). Avian abundance was highest on the two desert bajada grids, with 343 observations on the lower bajada grids and 289 on the upper bajada grids. Abundance was lower in the three heliostat grids, with 64 observations in Unit 1, 40 observations in Unit 2, and 14 observations in Unit 3.

During raptor and large bird surveys, eight raptor species and three other large bird species, including common raven and turkey vulture, were observed and identifiable. Common ravens comprised 58.6% of all raptor and large bird detections.

Avian and bat fatality monitoring 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 2,991 acres, which was surveyed with 24.1% coverage (720 acres) in randomly selected arc-shaped plots; 3) the "fenceline", consisting of the perimeter fences, which was 100% surveyed; 4) the "collector line", consisting of the Unit 3 electrical transmission line, which also was 100% surveyed; and 5) offsite transects. Overall, approximately 29.2% of the facility was searched (not including the offsite transects, which are outside the facility). Searches were conducted within the spring season at intervals of approximately 7 days.

All bird and bat fatalities and injuries, referred to as "detections" in this report, including those found incidentally and during standardized facility searches, were documented and categorized as singed, collision, other project causes or unknown based on examination with a binocular microscope and evidence collected from the location of the detection. During the period 16 March – 24 May 2015, a total of 3 bat fatalities, and 185 avian detections (including 12 injured birds), were found.

According to the specifications of the Plan, the number of avian detections were categorized by facility structure and cause. These avian fatality search results, along with searcher efficiency and carcass persistence rates from trials conducted onsite, were input into a fatality estimator model (Huso 2010) to provide an estimate of the fatalities for the facility.

Using the fatality estimator model, during the period 16 March – 24 May 2015, there were an estimated 464 fatalities (49.3%) from known causes and 477 fatalities (50.7%) from unknown causes. Of the known causes, 247 fatalities (53.2%) were estimated for the 2,991-acre heliostat area and 209 fatalities (45.0%) were estimated for the 154-acre tower area. Detections of known causes in the other areas were too low to provide separate estimates. Overall, based on the monitoring results and estimates for known causes for the 2015 spring season, the effect of the Project on birds will not rise above the "low" category.

Of the unknown causes, 26 fatalities (5.5%) were estimated for the tower area, and 424 fatalities (88.8%) were estimated for the heliostat area; detections of unknown causes in the other areas were too low to provide separate estimates. Driving this estimate was a large number of feather spots (33) comprising over half (61.1%) of all unknown-cause detections, which may lead to an over-estimate of fatalities with unknown cause.

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Section 1.0 Introduction

1.1 Project Background

The Ivanpah Solar Electric Generating System (referred to in this report as "Ivanpah" or "Project") consists of three solar 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 power tower. Ivanpah is located on approximately 1,457 hectares (3,600 acres) of Bureau of Land Management (BLM) land west of Interstate 15 near the town of 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 Project. 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 proponent 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/injury associated with species, age/sex, season, weather, and visibility.
- Objective 4: Document spatial patterns associated with collision- or flux-related mortality/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 of 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 second "quarterly" (i.e., seasonal) report for the second year of monitoring (or, the sixth quarterly report) summarizing monitoring methods and results for avian and bat fatalities and injuries 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 2015 spring season, which includes the period from 16 March – May 24, 2015.

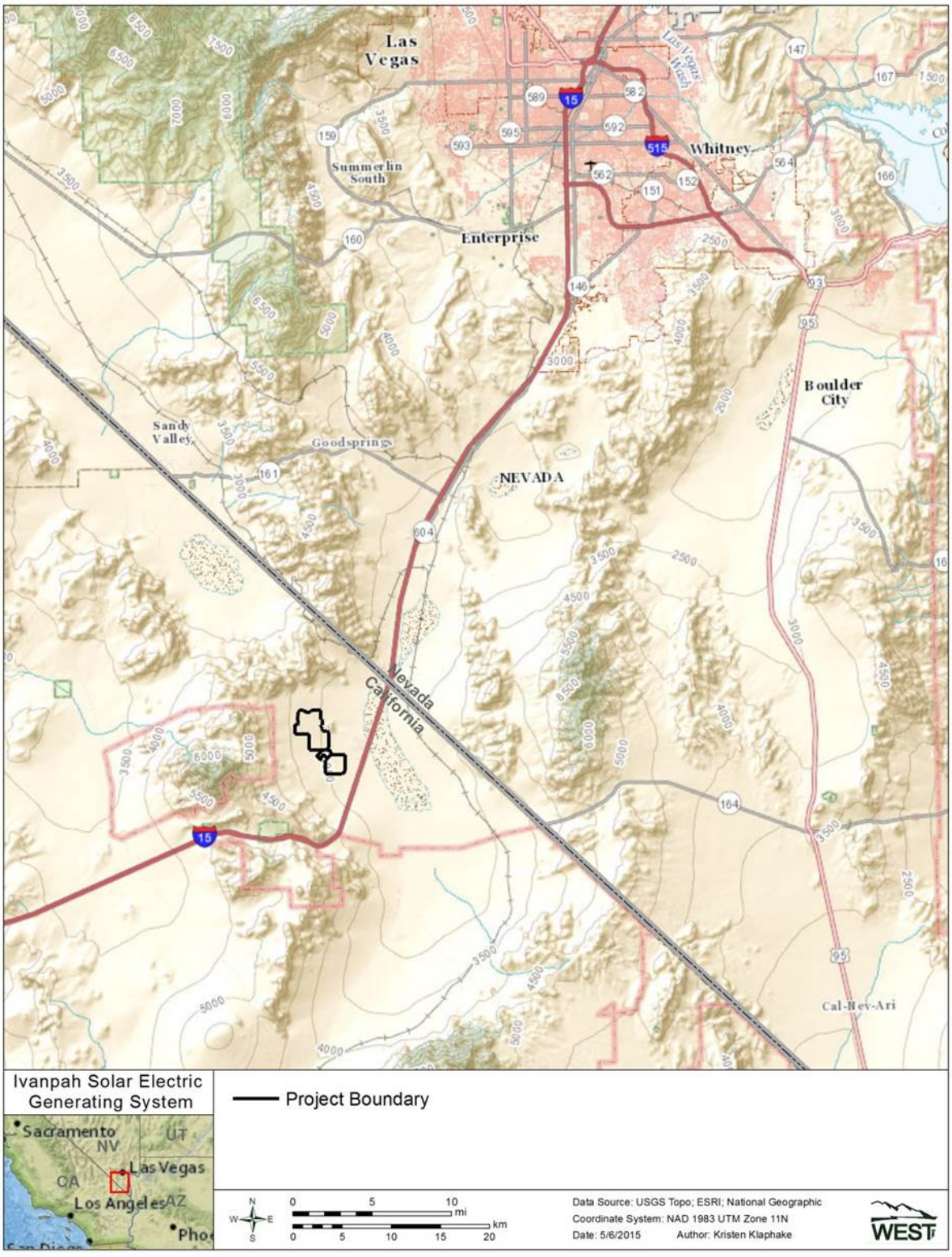

Figure 1. Ivanpah Vicinity Map.

Section 2.0 Methods

The Plan describes the methods by which monitoring and certain analyses, including compilation of the overall fatality estimate, occurred. Below is an abridged description of methods (see Plan for detailed methods), with greater detail provided when methods differ from original Plan.

2.1 Avian Use Monitoring

Methods for monitoring avian use of the Project and nearby desert areas, as well as the methods for monitoring the occurrence of raptors and other large birds on and around the facility are described in this section.

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 associated with each unit as well as nearby (offsite) areas of desert habitat. Eighty survey points (Figure 2) were surveyed by CEC- and BLM-approved avian biologists. In accordance with the Plan, these 80 points were randomly selected from within the following five survey 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 fenceline.
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 (0.5-square-mile) located in Unit 3, in the upper bajada portion of the facility.
5. 20 points within an approximately 2.59 square-kilometer (1.0-square-mile) offsite study area located in comparable upper bajada environment and as far as practicable from (and southwest of) the Unit 3 fenceline.

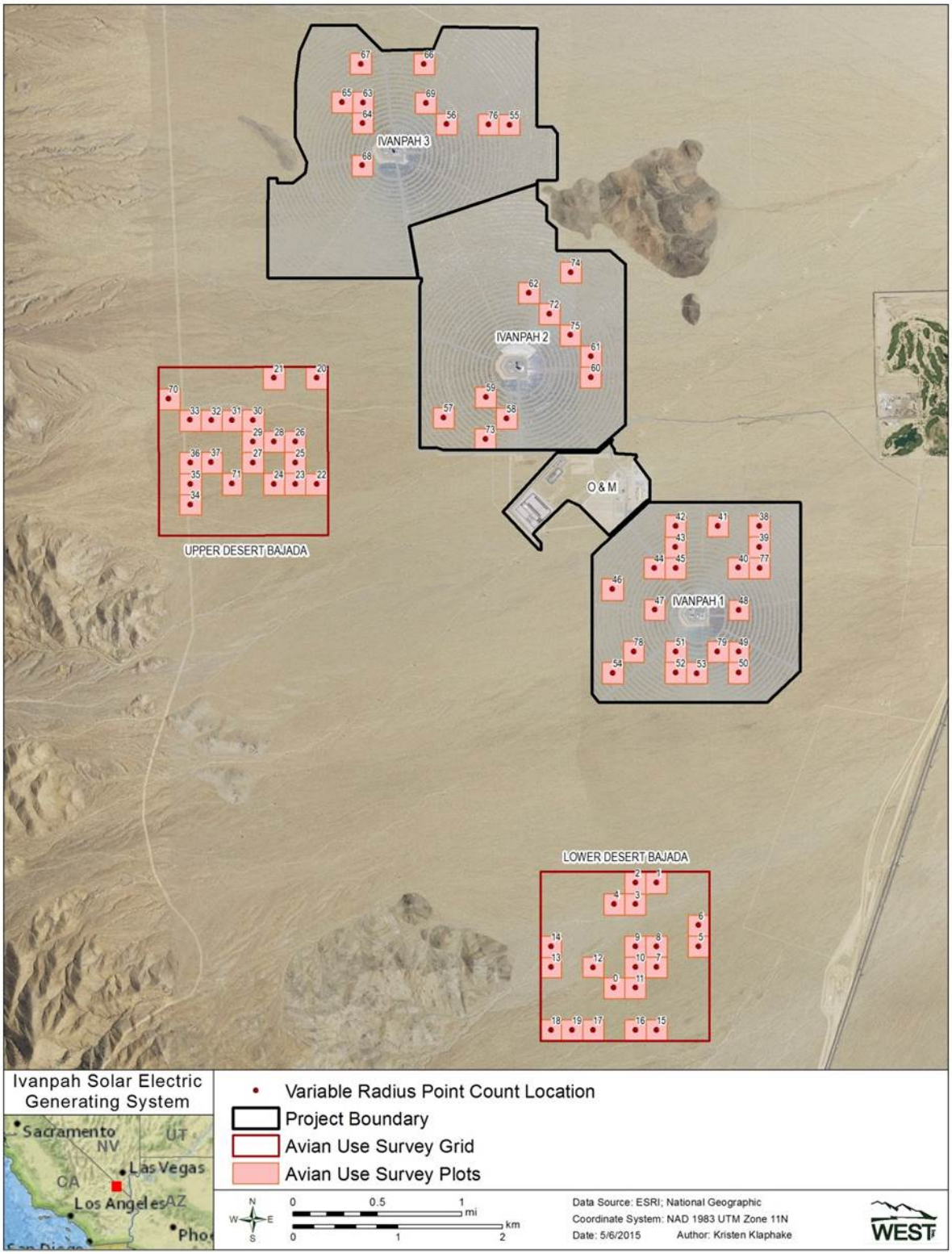

Figure 2. Avian Use Monitoring Survey Locations.

Each survey area described above was divided into 200-m by 200-m square areas to create distinct sample plots. Within each survey 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 off-site areas, with each count location affording a minimum, non-overlapping survey radius of 100 m. Points were surveyed for 10 minutes each, and were conducted between first light and three hours after sunrise.

The Plan prescribes that avian use surveys are conducted twice per month during March, April and May. To report avian use results consistent with fatality monitoring results, only the surveys conducted during the 2015 spring reporting period (March 16 – May 24, 2015) have been included in this report.

Data Analysis. According to the Plan, all birds heard or seen at each point up to 100 meters from the observer will be recorded to document species occurrence and estimate abundance. Thus, all birds observed are used to calculate species richness and abundance. Results for species composition (number of species recorded) and avian abundance (number of observations) are presented by survey area. For visualization of results, data from Unit 2 and Unit 3 are combined because these areas had 10 survey points compared to 20 survey points in other areas. Thus, when combined, Unit 2 and Unit 3 have an equivalent number of points to the other areas and results can be compared. In addition to the number of points in each survey area, the ability to compare results among survey areas depends on the number of visits. Mean use (number of birds/survey) are presented to standardize data among survey areas to account for unequal number of visits per survey area.

Avian abundance metrics such as total observations can help describe patterns in bird occurrence, especially when sampling effort is equal among survey areas. However, because survey effort differed among survey areas, and bird detectability varies among species (i.e., some birds are more easily detected then others) and could differ between the heliostat area and desert bajada area, other analytical methods may be more appropriate to examine patterns in bird use among survey areas (Buckland et al. 1993). As a result, program Distance 6.0 (Thomas et al. 2010) was used to evaluate avian densities for the heliostat area and desert bajada areas. Densities were calculated based on birds observed using the plots, only; thus, birds flying over or transitioning through the plot were not included in the density analysis.

The Cornell Lab of Ornithology's BirdCast website (www.birdcast.info) provides a regional migration forecast and a regional migration analysis, and uses two types of data; observations submitted voluntarily by birdwatchers through the eBird website (www.ebird.org) and radar data from over 140 weather stations. Taken together, these data can be used to examine trends in bird migration in spring and fall over broad geographic scales. BirdCast provides two data summaries: 1) a regional summary that uses radar and weather data to interpret bird movements and reports a range of migration amounts (e.g., light through heavy) based on the radar measurements used to compare the reflectivity of a remote object (decibels of Z value or dBZ); and 2) a list of 'species on the move' showing common migrant birds reported by birdwatchers in eBird with arrival and departure dates. Thus, the species on the move data relies on birdwatchers reporting observations, and birding 'hotspots' are likely overrepresented in the dataset compared to rural and less visited areas. The regional summaries provided in BirdCast are broad, and the West region includes Washington, Oregon, California, Idaho, Nevada, Utah, Arizona, Montana, Wyoming, Colorado, and New Mexico. Therefore, the BirdCast West regional migration analysis was examined for every week during the 2015 spring season for specific mentions of California or Desert

Southwest (what this region encompasses is undefined). Additionally, the BirdCast West regional migration analysis was examined for a distinct migration end date.

2.1.2 Raptor/Large Bird Monitoring Surveys

Surveys were conducted from each of eight points to assess raptor/large bird use of the facility and offsite project areas (Figure 3). The locations of the points relative to those described in the Plan are discussed in the Fall 2014 report.

Each point was surveyed for 4 hours per survey (except during weather hazards or other circumstances that required suspending the survey) using unlimited-distance point count methodology. CEC and BLM-approved avian biologists performed these surveys using binoculars and spotting scopes, recording detailed location and flight path data for all observed raptors and large birds, including shorebirds, waterfowl, and common raven (*Corvus corax*). The Plan specifies that surveys for raptors and other large birds be conducted twice per month during all months except summer (June – August). To report raptor and large bird results consistent with fatality monitoring results, only the surveys conducted during the 2015 spring reporting period (March 16 – May 24, 2015) were included in this report.

Data Analysis. Results for species composition (number of species), abundance (number of observations), and habitat use (location of the observation) are presented in Section 3.2. Although all raptors and large birds are recorded to an unlimited sight distance, according to the Plan, observations within 800 meters will be used for standardized assessments and comparison of mean use (number of observations/survey hour) for raptors and large birds. Based on the location of the bird observation, the habitat was classified as Ivanpah facilities (anywhere perched or flying over a part of the Project), desert, golf course, or mountains. The Clark Mountain Range lies to the North, West, and South of the Project with the foothills being approximately 3.2 km from the closest raptor and large bird survey point. Thus, given the distance to the mountains, raptors and other large birds likely had a lower detectability than those observed within 800 meters. In addition, Section 3.2 provides information on the number of individuals of these species observed perched versus those in flight, as well as the heights at which flying birds were recorded. 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 as the number of observations rather than individuals.

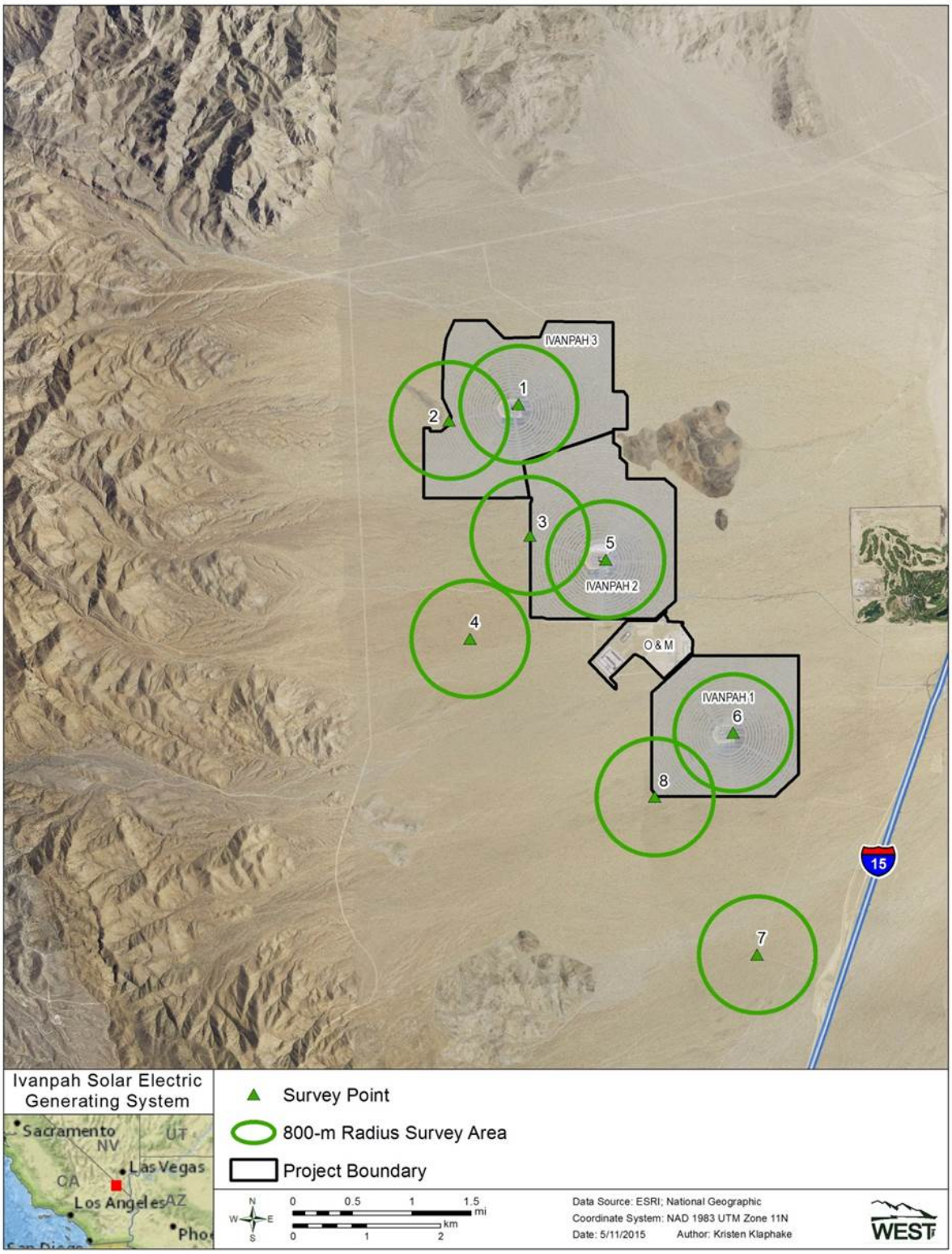

Figure 3. Raptor and Large Bird Use Monitoring Survey Locations.

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/injured birds and bats (hereafter detections) at the Project. This section also describes the methods for conducting carcass persistence and searcher efficiency trials; how data were reported and analyzed for incidental detections; and the methods for producing fatality estimates for the Project.

2.2.1 Standardized Searches

2.2.1.1 Areas Surveyed

Per the Plan, monitoring was 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 "fenceline" defined as the unit perimeter fences and common logistics area (CLA) fence (100% survey coverage); the "collector line", defined as the Unit 3 electrical transmission line (100% survey coverage); and offsite transects. 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 Project (not including the offsite transects, which are outside the facility) was searched (Figure 4).

To ensure a balanced distribution of heliostat field survey plots, each unit was divided into inner and outer heliostat fields, and approximately 20% of each sub-area was randomly selected for monitoring. 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, 2015 spring season.

Area	Acreage Searched	Percent of Facility
Tower Area	154	4.80%
Heliostat Area	720	22.40%
Fenceline	39	1.20%
Collector Line	26	0.80%
Offsite Transects	7	NA*
Total	939	29.20%

*NA = Not applicable as offsite survey areas are located outside of the facility

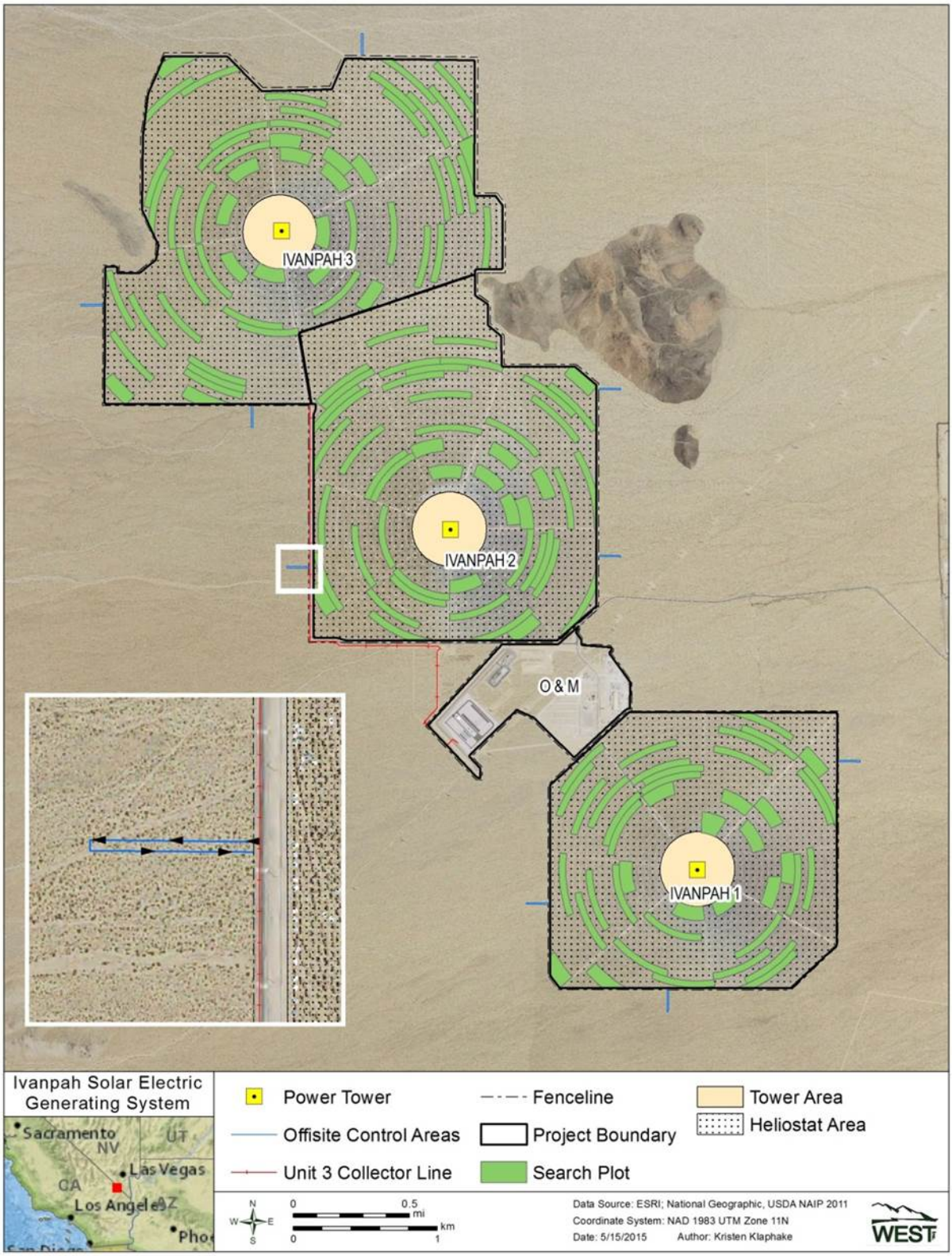

Figure 4. Ivanpah Search Areas.

2.2.1.2 Search Frequency and Timing

Standardized searches occurred at each unit on a 7-day interval through the 2015 spring season. Variation in search interval was anticipated to occur due to the transition from a 21-day search interval to a 7-day search interval between seasons of differing length. All survey areas of each unit were visited a total of eight times during the 2015 spring season.

2.2.1.3 Search Methods

Biologists performed surveys in the tower area, fenceline, offsite transects, collector line, and plots in the heliostat. Standardized walking surveys for fatalities were performed by CEC and BLM-approved biologists, in accordance with the methods outlined in the Plan. In the heliostat area, a pair of biologists 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). While walking each transect, biologists walked a narrow search section approximately 10 meters (m) wide. Within the power block, biologists walked through and around the power 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, excepting any areas that were physically inaccessible or unsafe to survey. Inaccessible areas were, to the extent possible, scanned using binoculars. Along the fenceline, a 6-m wide transect was surveyed, centered on the fence itself (i.e., 3 m on either side of the fence). The collector line was surveyed using a 30-m wide transect (i.e., 15 m on either side of the center line). Offsite transects were surveyed along two randomly selected 152-m long transects, separated by approximately 10 m extending outward from, and back to, the unit perimeter fence at nine locations (three per unit), including the north, east, south, and west borders of the facility.

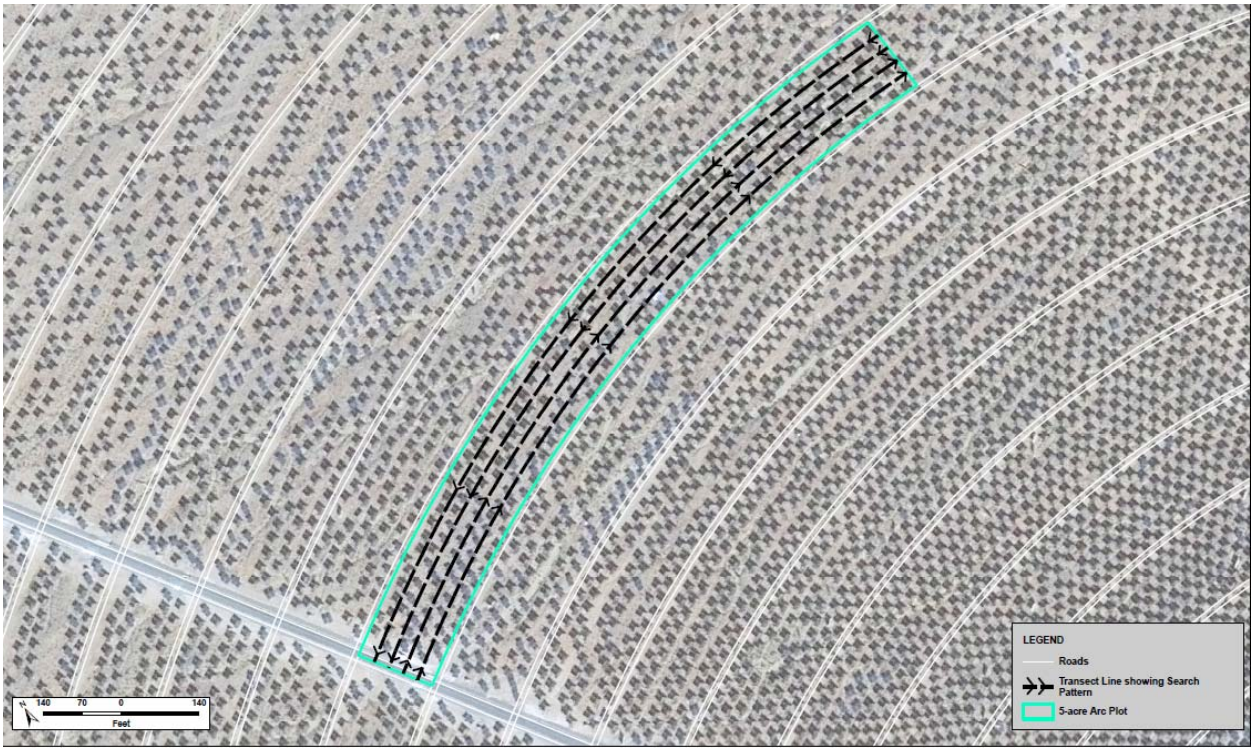

Figure 5. Monitoring Search Pattern for Arc Plots.

Carcass and Feather Spot Examination. Every carcass and feather spot was examined visually by a CEC and BLM-approved biologist for evidence of singeing or collision. Singeing to feathers can occur when a bird enters the flux around the power tower. When no obvious evidence of singeing or collision were evident to the naked eye, the carcass or feather spot was then examined using an AmScope SE306R-AZ-E2 20X-40X-80X Digital Binocular Stereo Microscope. When singed detections involving carcasses (as opposed to only feather spots) were found, the 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.

When a carcass was detected, biologists 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 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 met the following criteria:

At least two or more primary flight feathers, 5 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 was categorized as a partial carcass (rather than a feather spot), per the "feather spot" definition above.

2.2.2 Carcass Persistence Trials

Carcass persistence trials were performed throughout the 2015 spring monitoring season. At the request of the TAC, the number of trials conducted during the spring season was increased compared to previous monitoring periods. A total of 47 trials were conducted, divided among small (N=32) and large (N=15) bird carcasses. The facility contains vegetated and unvegetated areas that could affect the ability to detect a carcass or the amount of time a carcass persists until it is scavenged. The tower area (power block and inner high density (HD) heliostat area, where most singed detections occur, is unvegetated; all

other areas are considered vegetated. In order to examine carcass persistence times for vegetated and unvegetated areas, carcasses were also distributed through the facility, with 30 carcasses placed in the unvegetated tower area, and 17 carcasses placed in the vegetated heliostat arrays, along fence lines, or underneath the collection line. Non-native species were used for both size classes; house sparrows (*Passer domesticus*) were used for small carcass trials, and rock pigeons (*Columbia livia*) were used for all large birds trials conducted during the 2015 spring monitoring season. A camera was placed at each carcass to record the time of scavenging and the scavenging species.

2.2.3 Searcher Efficiency Trials

Searcher efficiency trials were conducted throughout the 2015 spring monitoring season, and at the request of the TAC, the number of trials conducted was increased compared to previous monitoring periods. A total of 100 searcher efficiency trials (43 small birds, 30 large birds, and 27 feather spots) were conducted during the 2015 spring monitoring season. 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. Trials were placed in the heliostat fields and tower areas of all three units; however, no trials were placed in the ACC building since detection probability is assumed to be 100% in this area of the power block. Ground cover along the fence line and underneath overhead lines is similar to that of the heliostat fields, therefore no searcher efficiency trials were placed in these survey areas. Overall, 59 trial carcasses/feather spots were placed in the Tower Area and 41 trial carcasses were placed in vegetated areas in the inner/outer segments of the heliostat area.

As detection dog searches were discontinued prior the start of the 2015 spring monitoring season; no dog detection trials were conducted during the 2015 spring monitoring season.

2.2.4 Incidental Reporting

Some detections were outside standardized search areas, or were within search areas but not during standardized searches. Such detections were found by the Project's designated biologists and operational personnel. These detections were reported in accordance with the facility's Wildlife Incident Reporting System (described in Section 3.4 of the Plan) and were considered "incidental" detections. Data on these incidental detections were 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., tower area or along the fenceline) during time periods in which those areas were being searched. Incidental detections from outside the survey areas or during time periods in which areas are not being searched are not included in the fatality estimates; however, all detections regardless of the method or source of detection are reported in the SPUT permit database.

2.2.5 Fatality Estimator

Fatality rate estimation is a complex task due to several variables inherent to every fatality monitoring study. Carcasses may persist for variable amounts of time due to local scavenger activity or environmental conditions leading to carcass degradation over time. Carcasses and feather spots are also detected with varying levels of success based on carcass characteristics and ground cover (e.g., vegetated areas underneath heliostats versus cleared areas around towers). For these reasons, it is generally inappropriate to draw conclusions based on the raw number of fatalities alone. The desire to estimate fatalities given these variables has driven the development of several statistical methods for estimating

fatalities (e.g., Smallwood 2007, Huso 2010, Korner-Nievergelt 2011). All of these fatality estimation methods share a similar underlying model. Generally, the fatality estimation for a given site may be expressed as:

$$F=C/rp,$$

where F is the total number of fatalities, C is the number fatalities detected and included in fatality estimation, r is the probability a carcass is unscavenged and available to be found at the end of the search interval, and p is the probability of detecting a carcass (Huso 2010).

The bias correction factors r and p are estimated by covariates that may influence the detectability and persistence of each carcass, such as carcass size, presence of vegetation, and stage of decay or scavenging (i.e., feather spot versus carcass). For this study, the Huso estimator was used to correct for detection and scavenging bias; the estimator was demonstrated to perform well under a variety of conditions (Huso 2010). The Huso model was developed in the context of estimating fatalities for post-construction fatality studies at wind energy facilities; however, the Huso estimator is suitable for other sources of anthropogenic avian mortality, including power lines and utility scale solar facilities (Huso 2010).

All fatality estimates were calculated using the Huso estimator, as well as 90% confidence using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. A total of 1,000 bootstrap replicates were used. The lower 5th and upper 95th percentiles of the 1,000 bootstrap estimates provide estimates of the lower limit and upper limit of an approximate 90% confidence interval on all estimates.

Estimating Carcass persistence Times. Measurements of carcass persistence rates are often subject to censoring. In this context, censoring refers to the fact that a value (e.g., days a carcass is present before being removed) may not be known exactly, but within a finite range. For example, suppose a carcass was checked on day 7 and was present, and was checked again on day 10, but was found to be missing. The exact time until removal is unknown; however, it is known that the carcass was available to be found for between 7 and 10 days. This carcass would be considered "interval censored". Similarly, if a carcass lasts the entire six-week trial period, that carcass is "right censored"—we know the carcass lasted at least six weeks, but it could have persisted longer. Due to the fact that camera traps (e.g., cameras that automatically document activity at the trial carcass) were used for carcass persistence trials, the majority of scavenging times were known precisely, and the data were not censored. However, when cameras failed to record the moment of scavenging, interval censoring was applied.

There are four commonly used distributions implemented in the survival models used to estimate the value of r: exponential, Weibull, loglogistic, and lognormal. These four distributions exhibit varying degrees of flexibility in order to model a wide variety of removal time distributions. Akaike's Information Criterion adjusted for sample size (AICc; Akaike 1973) was used to rank the fit of each survival model fit to carcass persistence data. The exact time of death for detected fatalities is usually unknown, so the probability of persistence cannot be calculated exactly for each carcass; however, it can be estimated from the selected survival model and bootstrapped to obtain a range of estimates of r for each carcass. In the 2013 – 2014 winter through 2014 – 2015 winter reports, carcass size was included as a covariate in one

carcass persistence model. Beginning 2015 spring individual models were fit for small birds and large birds due to the distinct difference in carcass persistence time between the two size classes. See Section 5.1.2 for details on the model fitting procedure.

Estimating Searcher Efficiency. Searcher efficiency, or the proportion of carcasses detected, *p*, is represented most simply by the following equation:

$$p = \frac{Number\ of\ Carcasses\ Observed}{Number\ of\ Carcasses\ available}$$

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. *A priori* decisions were not made regarding whether vegetative cover would differ between seasons, but rather, searcher efficiency trials were conducted in all season. Following the completion of fall searcher efficiency trials, there was sufficient cumulative data for the year to assess whether searcher efficiency differed significantly by Project area (e.g., unvegetated tower area versus vegetated heliostat fields), season, and/or carcass size. The nearly complete lack of vegetation cover in the tower area suggested that searcher efficiency may be higher in the tower area than in other Project areas. If this hypothesis were true, accounting for this difference in searcher efficiency across Project areas would be important for producing accurate fatality estimates.

To evaluate various hypotheses regarding differences in carcass detectability among Project areas, seasons, and/or carcass size, logistic regression models were fit to searcher efficiency data and corrected Akaike's Information Criteria (AICc) was used to compare models. The Project area was defined using two categories to reflect the suspected differences in searcher efficiency due to differences in vegetation cover: the tower area, which consists of the power block and the inner HD heliostats, and other areas, which consists of all other Project areas not included in the tower area. Models were constructed for season, carcass size, Project area, and Project area plus carcass size, and compared to the null model (Table 15). There were too few trials of some carcass sizes in some seasons to consider a model with season and carcass size combined. The data for this analysis included all human searcher efficiency trials of carcasses from the beginning of trials in the winter 2013 – 2014 season through the 2015 spring season.

Fatality Estimates. Per Section 3.1 of the Plan, estimates for the number of detections in the tower area components (i.e., the power block and inner HD heliostats) are reported separately and combined, because 100% of these areas was searched. Power block and inner HD estimates were calculated separately due to the inclusion of many more incidental observations from the power block. A separate estimate was produced for the heliostat area (the inner and outer heliostat segments combined), in which 24.1% of the total area was searched. Fatality estimates reported in the inner/outer heliostat areas were adjusted to account for the unsearched area in the inner/outer heliostat areas (i.e., divided by 0.241).

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. Furthermore, carcasses are, generally, visible against the industrial backgrounds. Thus, the fatalities found in the ACC were not adjusted using the Huso estimator; rather, raw counts of ACC detections were added to fatality estimates

for the power block. 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.

Within the power block, during the 2015 spring season, incidental detections accounted for 33.7% of the detections recorded. Thus, as treated in previous analyses, incidentals found within the power block were included in estimates, but handled differently from other fatalities. To reflect the high human activity in the power block—and frequent observation of the areas within the power block—the search interval for these detections was set to one day.

In previous seasons, incidental detections found outside of the power block but within standardized search areas were partially processed in the field and left in place to give searchers the opportunity to discover the carcass on the next scheduled search. This method was discontinued in the 2015 spring season to prevent the scenario where an incidental detection is recorded, left in place, but scavenged before the next standard search and no carcass is associated with the data. In the 2015 spring season, incidental detections found outside of the power block, but within standardized search areas were removed from field and included in fatality estimates under the conservative assumption that the search interval was the time between the last search of the area and the time of incidental discovery.

All fatality estimators have limitations, particularly when fatality counts are low. In particular, when detections are five or fewer, regardless of survey effort, estimates and confidence intervals can be subject to uncontrolled bias and must be interpreted with caution (Korner-Nievergelt et. al 2011). Rather than report estimates with little inferential value, no estimates were provided for combinations of covariates (e.g. size, location, cause) resulting in fewer than five detections.

The fatality estimator accounts for imperfect detection probability by using bias trials to estimate searcher efficiency. The Huso estimator is constructed under the assumption that searchers have a single opportunity to discover a carcass. Therefore if a carcass is missed on the first search it was available, then found on the next search, it will effectively be over-counted. The method typically used to overcome multiple-detection-bias is to exclude any detection determined to be significantly older than the search interval. Each detection made during the 2015 spring season was evaluated for exclusion from the estimator based on the observed time since death (i.e., the length of time between an animal's death and when the detection was discovered), and the search interval associated with that detection. For example, if a detection determined to have been on the ground for > 1 week was made in the inner HD of Unit 2, which had been searched 7 days earlier, that carcass would be excluded from analysis.

To correctly account for searcher efficiency in the fatality estimate 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, small carcass, or large 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. Because searcher efficiency is an important component of the fatality estimator, what the surveyors detect first (i.e., feather spot versus a 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.

2.3 Deterrence Measures

2.3.1 Avian Measures

Ivanpah commenced an investigation of the use of various deterrence measures to reduce avian mortality at the facility in 2013. These initial investigations combined with the results of the monitoring conducted during 2014 resulted in a list of potential deterrence measures for adaptive management. The list of deterrence measures has been updated, and progress reports towards deterrence implementation have been provided to the TAC on a periodic basis.

Several deterrence measures have been implemented at Unit 1 for birds, including installation of LED lighting that is not attractive to insects and deterrence spikes on the lighting fixtures along with avian chemosensory and sonic deterrence systems. Specifically, new ground-level LED lighting and spikes were installed 5 February 2015. A chemosensory deterrence measure commercially known as BirdBuffer, was deployed on 12 October 2014, and a sonic deterrence measure commercially known as BirdGard, was deployed on 13 March 2015. The chemosensory deterrence measure is hypothesized to deter resident species, since the deterrent induces a conditioned response over time, and the sonic deterrence measure is hypothesized to deter transient and migrant species, as the sounds produced by the system are thought to startle and deter subjects. Together, the combination of BirdBuffer and BirdGard systems are intended to deter avian species from entering this area associated with elevated flux mortality. Evaluation of the effectiveness of deterrents is ongoing and will be reported at a later date, after more than a single season of data has been collected.

2.3.2 Bat Measures

Bat fatalities were detected primarily in the ACC, and as the ACC provides a roosting location, a Binary Acoustic Technology Ultrasonic Bat Deterrence was tested at Unit 3. The bat deterrence measure is not designed to elicit a fear response in bats, but is designed to interfere with the echolocation capabilities of bats. As bats navigate utilizing sonar, the method deployed "jams" the sonar signals and bats species avoid the area as a result of the inherent difficulties to navigate under these conditions. Although bats can adjust echolocation under jamming conditions, the use of broadband ultrasound requires bats to shift frequencies to avoid overlap that interferes with echolocation and therefore deters within the area subject to broadband ultrasound (Arnett, et al, 2013). As a result of the broadband ultrasonic signal and the inherent "jamming" effect, adaptation to the deterrence measure is minimal. The deterrence measure has been installed at all Units, and the installation dates are as follows: 10 September 2014 at Unit 1, 23 April 2015 at Unit 2, and 23 April at Unit 3. Monitoring of these deterrence measures compares bat fatalities before and after the date of installation at each unit.

Section 3.0 Avian Use and Raptor/Large Bird Monitoring Survey Results

3.1 Avian Use Monitoring

During the 2015 spring season, a total of 340 avian use counts were conducted across all survey areas and points. Survey effort among survey areas was as follows: upper bajada = 80 counts, lower bajada = 110 counts, Unit 1= 80 counts, Unit 2 and Unit 3 combined = 70 counts. Mean use (birds/survey) is presented to account for unequal survey effort among survey areas.

3.1.1 Species Richness

A total of 41 bird species were recorded during avian use surveys during the 2015 spring season. Species richness was highest in the lower bajada desert (25 species), followed by the upper bajada desert (22 species). Species richness was lower in the heliostat grids, with 14 species observed in Unit 1, 10 in Unit 2, and 5 in Unit 3 (with 10 unique species in Units 2 and 3 combined; Figure 6).

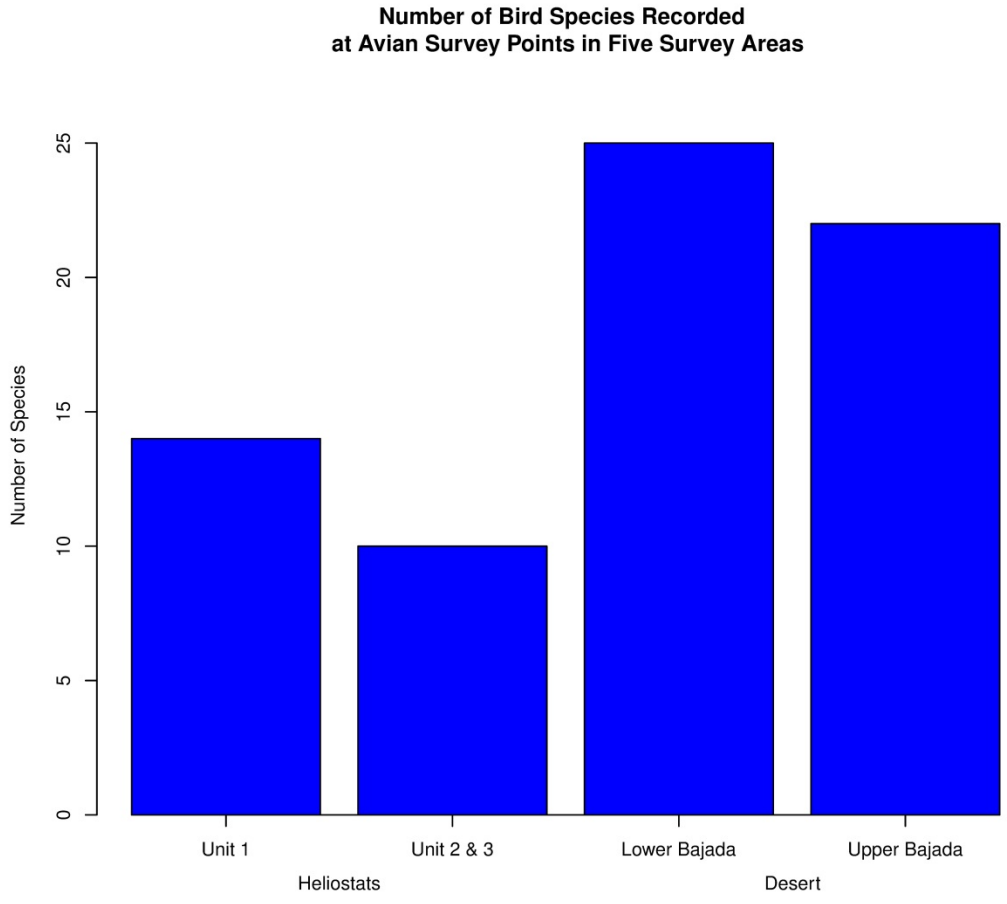

Figure 6. Number of Bird Species Recorded at Avian Survey Points on Five Survey Areas.

3.1.2 Avian Abundance and Density

A total of 750 observations were recorded during avian use surveys (Table 2a), with 632 observations on the desert bajada survey areas (84.2% of total observations). As with species richness, avian abundance was highest on the two desert bajada grids (289 observations on the upper bajada and 343 observations on the lower bajada). The three heliostat arrays had lower avian abundance, with 64 observations in Unit 1, and 54 in Unit 2 and Unit 3 combined (40 observations in Unit 2, and 14 observations in Unit 3; Figure 7). The most frequently detected species in the lower and upper desert bajada was the black-throated sparrow (36.7% of observations on the desert bajada survey areas). The horned lark was the most frequently detected species in the heliostat area (36.4% of observations on the heliostat survey areas) and was not observed in the desert bajada survey areas.

Avian mean use (birds/survey) was highest in the desert bajada survey areas, and lowest in Unit 2 and Unit 3 (Table 2b). Mean use at Unit 1 was higher than the other solar units, but a single species did not account for most of the activity at this Unit. Mean use in the desert bajada survey areas was influenced by several species including black-throated sparrow, cactus wren, Brewer's sparrow, and LeConte's thrasher (Table 2b). Of the five species with the highest mean use, horned lark and house finch had higher mean use at the heliostat areas compared to the desert bajada survey areas. The other three species – black-throated sparrow, cactus wren, and Brewer's sparrow had higher mean use at the desert bajada survey areas; Brewer's sparrow was not observed in the heliostat areas.

In order to accurately calculate density, a distance sampling analysis requires a fairly large amount of data. Due to the low number of individuals recorded for most species during these surveys (owing to the naturally low abundance of birds in the habitat surveyed), 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 grids). Under the assumption that the two heliostat grids were more similar to each other (in terms of habitat and resident 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 density of birds using desert bajada survey areas (1.87 birds/hectare) was greater than the density of birds using the heliostat survey areas (0.53 birds/hectare). Furthermore, 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 survey areas was significantly higher than bird density in the heliostat survey area (Table 3).

Table 2a. Avian Use Survey Results – Number of Observations by Species and Survey Grid.

Species	Unit 1	Unit 2	Unit 3	Upper Bajada	Lower Bajada	Total
black-throated sparrow	10	9	0	85	128	232
cactus wren	0	2	0	70	69	141
Brewer's sparrow	0	0	0	18	46	64
horned lark	17	17	9	0	0	43
house finch	15	9	2	7	5	38
Le Conte's thrasher	0	0	0	25	10	35
ash-throated flycatcher	0	0	0	7	25	32
loggerhead shrike	0	1	0	15	10	26
common raven	7	0	1	5	6	19
white-crowned sparrow	0	0	0	18	0	18
Bewick's wren	0	0	0	5	8	13
verdin	0	0	0	9	3	12
blue-gray gnatcatcher	0	0	0	4	3	7
yellow-rumped warbler	1	0	0	4	2	7
white-throated swift	0	0	0	6	0	6
American pipit	5	0	0	0	0	5
gray flycatcher	0	0	0	2	2	4
lark sparrow	0	1	0	0	3	4
mourning dove	0	1	0	0	3	4
violet-green swallow	1	0	0	0	3	4
lesser nighthawk	0	0	0	0	3	3
western kingbird	0	0	0	2	1	3
barn swallow	1	0	0	1	0	2
black-throated blue warbler	0	0	0	2	0	2
chipping sparrow	0	0	0	0	2	2
Gambel's quail	0	0	0	0	2	2
northern rough-winged swallow	2	0	0	0	0	2
unidentified sparrow	0	0	0	0	2	2
western meadowlark	1	0	0	1	0	2
western tanager	1	0	0	0	1	2
Wilson's warbler	0	0	0	0	2	2
American kestrel	0	0	1	0	0	1
blue-throated hummingbird	0	0	0	0	1	1
Bullock's oriole	0	0	0	1	0	1
house wren	0	0	1	0	0	1
ladder-backed woodpecker	0	0	0	1	0	1
least sandpiper	1	0	0	0	0	1
Nashville warbler	0	0	0	0	1	1
northern harrier	1	0	0	0	0	1
rock wren	0	0	0	1	0	1
Sagebrush sparrow	0	0	0	0	1	1
Savannah sparrow	1	0	0	0	0	1
unidentified passerine	0	0	0	0	1	1
Total	64	40	14	289	343	750

Table 2b. Avian Use Survey Results – Mean use (Birds/Survey) by Species and Survey Grid.

Species	Unit 1	Unit 2	Unit 3	Upper Bajada	Lower Bajada	Total
black-throated sparrow	0.125	0.129	0	1.062	1.164	2.48
cactus wren	0	0.029	0	0.875	0.627	1.531
Brewer's sparrow	0	0	0	0.225	0.418	0.643
horned lark	0.212	0.243	0.129	0	0	0.584
house finch	0.188	0.129	0.029	0.088	0.045	0.479
Le Conte's thrasher	0	0	0	0.312	0.091	0.403
ash-throated flycatcher	0	0	0	0.088	0.227	0.315
loggerhead shrike	0	0.014	0	0.188	0.091	0.293
white-crowned sparrow	0	0	0	0.225	0	0.225
common raven	0.088	0	0.014	0.062	0.055	0.219
verdin	0	0	0	0.112	0.027	0.139
Bewick's wren	0	0	0	0.062	0.073	0.135
yellow-rumped warbler	0.012	0	0	0.05	0.018	0.08
blue-gray gnatcatcher	0	0	0	0.05	0.027	0.077
white-throated swift	0	0	0	0.075	0	0.075
American pipit	0.062	0	0	0	0	0.062
gray flycatcher	0	0	0	0.025	0.018	0.043
lark sparrow	0	0.014	0	0	0.027	0.041
mourning dove	0	0.014	0	0	0.027	0.041
violet-green swallow	0.012	0	0	0	0.027	0.039
western kingbird	0	0	0	0.025	0.009	0.034
lesser nighthawk	0	0	0	0	0.027	0.027
black-throated blue warbler	0	0	0	0.025	0	0.025
northern rough-winged swallow	0.025	0	0	0	0	0.025
barn swallow	0.012	0	0	0.012	0	0.024
western meadowlark	0.012	0	0	0.012	0	0.024
western tanager	0.012	0	0	0	0.009	0.021
chipping sparrow	0	0	0	0	0.018	0.018
Gambel's quail	0	0	0	0	0.018	0.018
unidentified sparrow	0	0	0	0	0.018	0.018
Wilson's warbler	0	0	0	0	0.018	0.018
American kestrel	0	0	0.014	0	0	0.014
house wren	0	0	0.014	0	0	0.014
Bullock's oriole	0	0	0	0.012	0	0.012
ladder-backed woodpecker	0	0	0	0.012	0	0.012
least sandpiper	0.012	0	0	0	0	0.012
northern harrier	0.012	0	0	0	0	0.012
rock wren	0	0	0	0.012	0	0.012
Savannah sparrow	0.012	0	0	0	0	0.012
blue-throated hummingbird	0	0	0	0	0.009	0.009
Nashville warbler	0	0	0	0	0.009	0.009
Sagebrush sparrow	0	0	0	0	0.009	0.009
unidentified passerine	0	0	0	0	0.009	0.009
Total	0.796	0.572	0.2	3.609	3.115	8.292

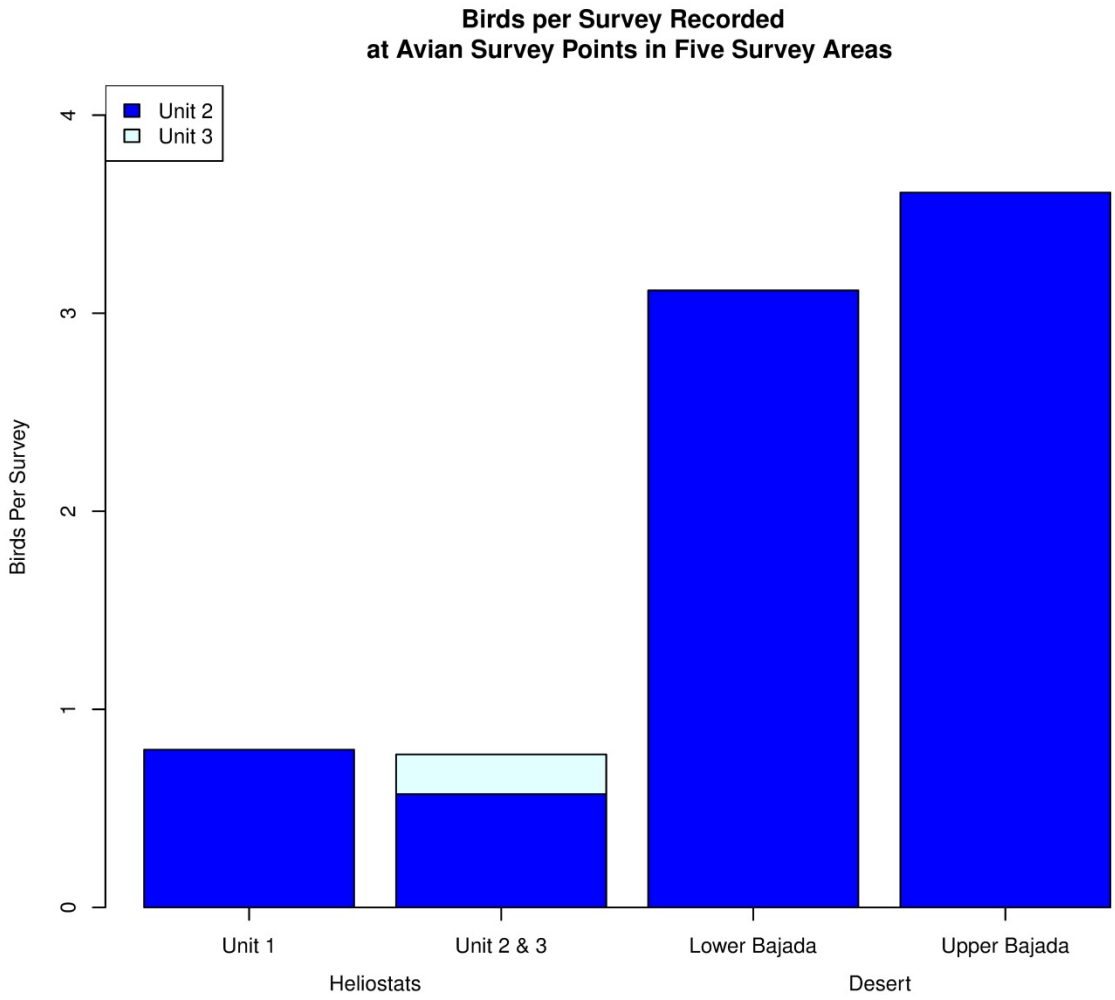

Figure 7. Mean Use (Birds/Survey) Recorded at Avian Survey Points on Five Survey Areas.

Table 3. Avian Density Estimates for Heliostat vs. Desert Bajada Survey Area (Derived Using Program DISTANCE).

Stratum	Estimate (birds/hectare)	%Coefficient of Variation	95% Confidence Interval Low	95% Confidence Interval High
Desert				
Half-normal/Cosine adjustment order 2	1.87	19.15	1.29	2.72
Heliostats				
Half-normal/No Cosine adjustment	0.53	14.00	0.40	0.70

3.2 Raptor and Large Bird Use Monitoring

During the 2015 spring season, a total of 34 surveys were conducted at the eight survey points for a total of 132 hours. As the fatality monitoring period did not include the first full or last month of the survey period, the number of surveys per point is as follows: 1 = 3, 2 = 2, 3 = 5, 4 = 5, 5 = 6, 6 = 4, 7 = 5, 8 = 4. Mean use (birds/survey hour) is presented to account for unequal survey effort among points.

3.2.1 General Species Composition, Abundance, and Habitat Use

During the surveys, eight raptor species and two other large bird species were observed and identifiable Table 4). A total of 99 observations of raptors and large birds were recorded to unlimited distance (Table 4).

Table 4. Raptor/Large Bird Point Count Results Summary (Number of Total Observations).

Species	Ivanpah Facilities	Off Site - Desert	Total	Species Composition
common raven	25	33	58	58.6%
red-tailed hawk	12	5	17	17.2%
golden eagle	4	3	7	7.1%
American kestrel	0	4	4	4.0%
turkey vulture	4	0	4	4.0%
osprey	2	0	2	2.0%
prairie falcon	2	0	2	2.0%
merlin	1	0	1	1.0%
peregrine falcon	0	1	1	1.0%
sharp-shinned hawk	1	0	1	1.0%
unidentified hawk	0	1	1	1.0%
unidentified raptor	1	0	1	1.0%
Total	51	48	99	100.0%

Common ravens comprised 58.6% of all large bird observations detected during raptor/large bird surveys. Common ravens were observed more frequently at Ivanpah facilities (56.9% of common raven observations) than in the nearby desert (43.1% of common raven observations); none were observed toward the mountains. The second most frequently observed raptor or large bird was red-tailed hawk (*Buteo jamaicensis*), which accounted for 17.2% of raptor and large bird observations. Most red-tailed hawks were observed over the desert (70.59% of red-tailed hawk observations). American kestrels (*Falco sparverius*) were only observed at Ivanpah facilities (100% of American kestrel observations); none were observed in the mountains although this falcon's small size makes very distant observations difficult. Seven golden eagle (*Aquila chrysaetos*) observations were recorded, with 4 at Ivanpah facilities (57.1% of observations and 3 in the desert (42.9 % of observations).

Mean use (birds/survey hour) within 800 meters was highest for common raven among raptors and large birds observed during surveys (Table 5). Common raven mean use was at more than six times higher

and five times higher than all other raptors and large birds at the Ivanpah facilities and the desert, respectively.

During the 2015 spring season, there were three incidental observations of golden eagles recorded outside of standard raptor surveys. Two of the incidental observations were seen over the facility, and one was seen over the desert outside of the facility. No other raptors or large birds were recorded incidentally during the spring 2014 season.

Table 5. Raptor/Large Bird Mean Use (Birds/Survey Hour) within 800 meters.

Species	Desert	Ivanpah Facilities
common raven	0.995	2.029
American kestrel	0	0.292
golden eagle	0	0.258
red-tailed hawk	0.1	0.25
merlin	0.05	0
osprey	0.1	0
prairie falcon	0.05	0
turkey vulture	0.1	0

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 in areas closer to the power towers (primary boiler area at 120–140 m agl))
- 3 = > 200 m agl (above the elevated solar flux risk zone)

For raptors and large birds observed within 800 meters during surveys, more birds were observed in-flight (89.7% of observations) compared to perched (10.3% of observations; Table 6) at the Ivanpah facilities. Outside of the Ivanpah facilities, no perched birds were observed. Seventy percent of all in-flight observations were at or below 100 m agl for all raptors and large birds. One golden eagle observation during surveys occurred within the tower area (Figures 8 – 15).

Table 6. Flight Heights of Raptors and Other Large Birds Over Ivanpah Facilities and Other Habitats/Areas within 800 meters.

	Outside Ivanpah Facilities Flight Height Category						At Ivanpah Facilities Flight Height Category					
Species	0	1	2	3	Perched	Total	0	1	2	3	Perched	Total
American kestrel	0	0	0	0	0	0	0	4	0	0	0	4
common raven	1	9	0	2	0	12	7	17	1	1	4	30
golden eagle	0	0	0	0	0	0	0	1	1	1	0	3
merlin	0	0	0	1	0	1	0	0	0	0	0	0
osprey	0	0	0	2	0	2	0	0	0	0	0	0
prairie falcon	0	0	0	1	0	1	0	0	0	0	0	0
red-tailed hawk	0	1	0	1	0	2	0	2	0	2	0	4
turkey vulture	0	1	0	1	0	2	0	0	0	0	0	0
Total	1	11	0	8	0	20	7	24	2	4	4	41

3.2.2 Raptor and Large Bird Distribution

Common raven was the most numerous raptor or large bird recorded within 800 meters, (Table 7a). The second most abundant raptor or large bird was red-tailed hawk followed by American kestrel. Raptor and large bird mean use was highest at points 6 and 5, and lowest at point 7 (Table 7b). Mean use was similar among all other points. Only 2 common raven observations were recorded at point 7, and point 8 is the only point with one raptor or large bird species recorded.

Table 7a. Raptor/Large Bird Point Count Results By Survey Point within 800 meters.

Species	1	2	3	4	5	6	7	8	Total
American kestrel	3	0	0	0	1	0	0	0	4
common raven	1	4	3	3	9	17	2	4	43
golden eagle	1	1	1	0	0	0	0	0	3
merlin	0	0	1	0	0	0	0	0	1
osprey	0	0	0	2	0	0	0	0	2
prairie falcon	0	0	1	0	0	0	0	0	1
red-tailed hawk	0	0	0	1	2	2	1	0	6
turkey vulture	0	0	0	2	0	0	0	0	2
Total	5	5	6	8	12	19	3	4	62

Table 7b. Raptor/Large Bird Mean Use within 800 meters (Birds/survey hour)

Species	1	2	3	4	5	6	7	8
American kestrel	0.25	0	0	0	0.042	0	0	0
common raven	0.083	0.5	0.15	0.15	0.375	1.416	0	0.25
golden eagle	0.083	0.125	0.05	0	0	0	0	0
merlin	0	0	0.05	0	0	0	0	0
osprey	0	0	0	0.1	0	0	0	0
prairie falcon	0	0	0.05	0	0	0	0	0
red-tailed hawk	0	0	0	0.05	0.083	0.167	0	0
turkey vulture	0	0	0	0.1	0	0	0	0
Total	0.416	0.625	0.3	0.4	0.5	1.583	0	0.25

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 raptor and other large bird activity.

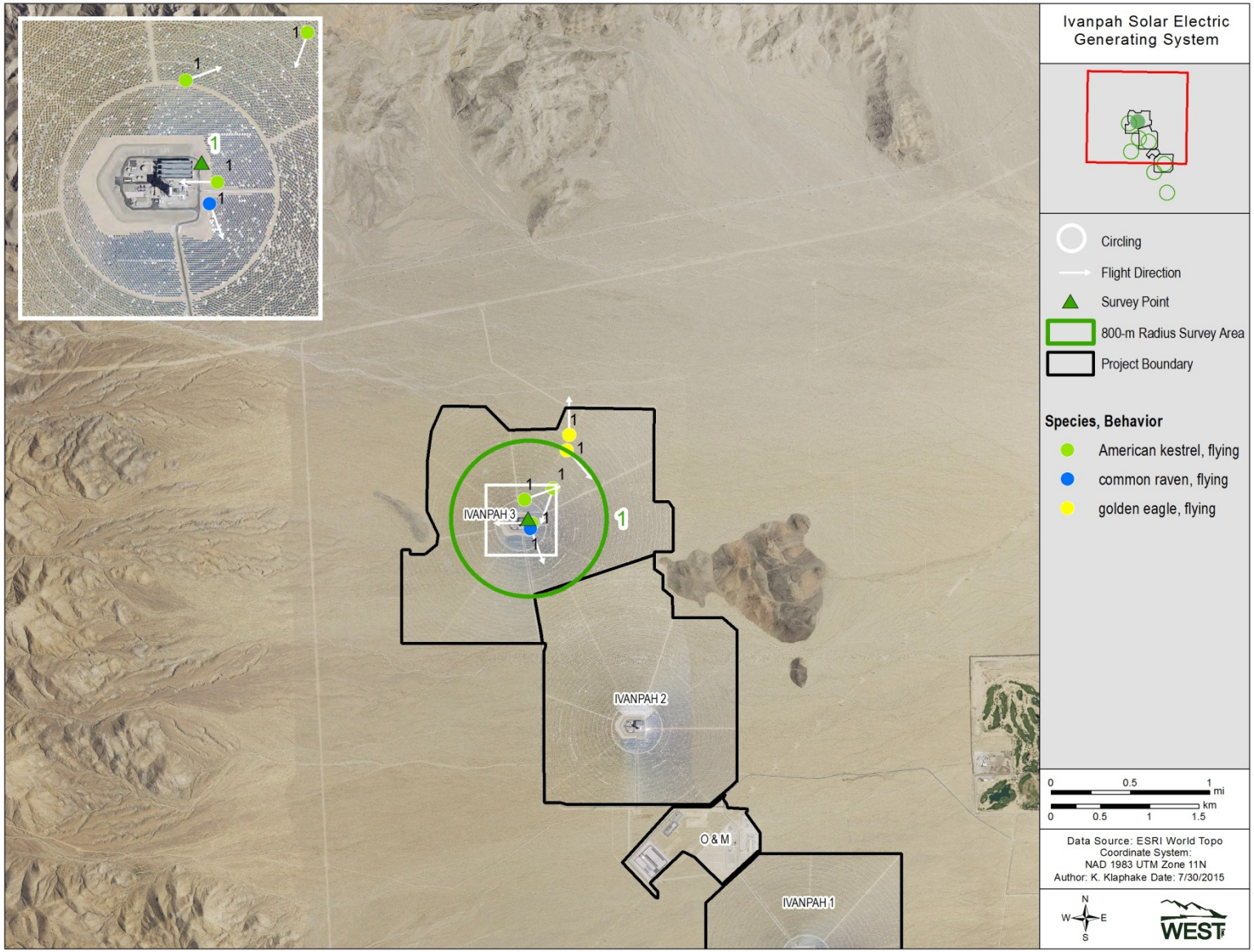

Figure 8. Raptor/Large Bird Survey Observations from Survey Point 1, 2015 Spring.

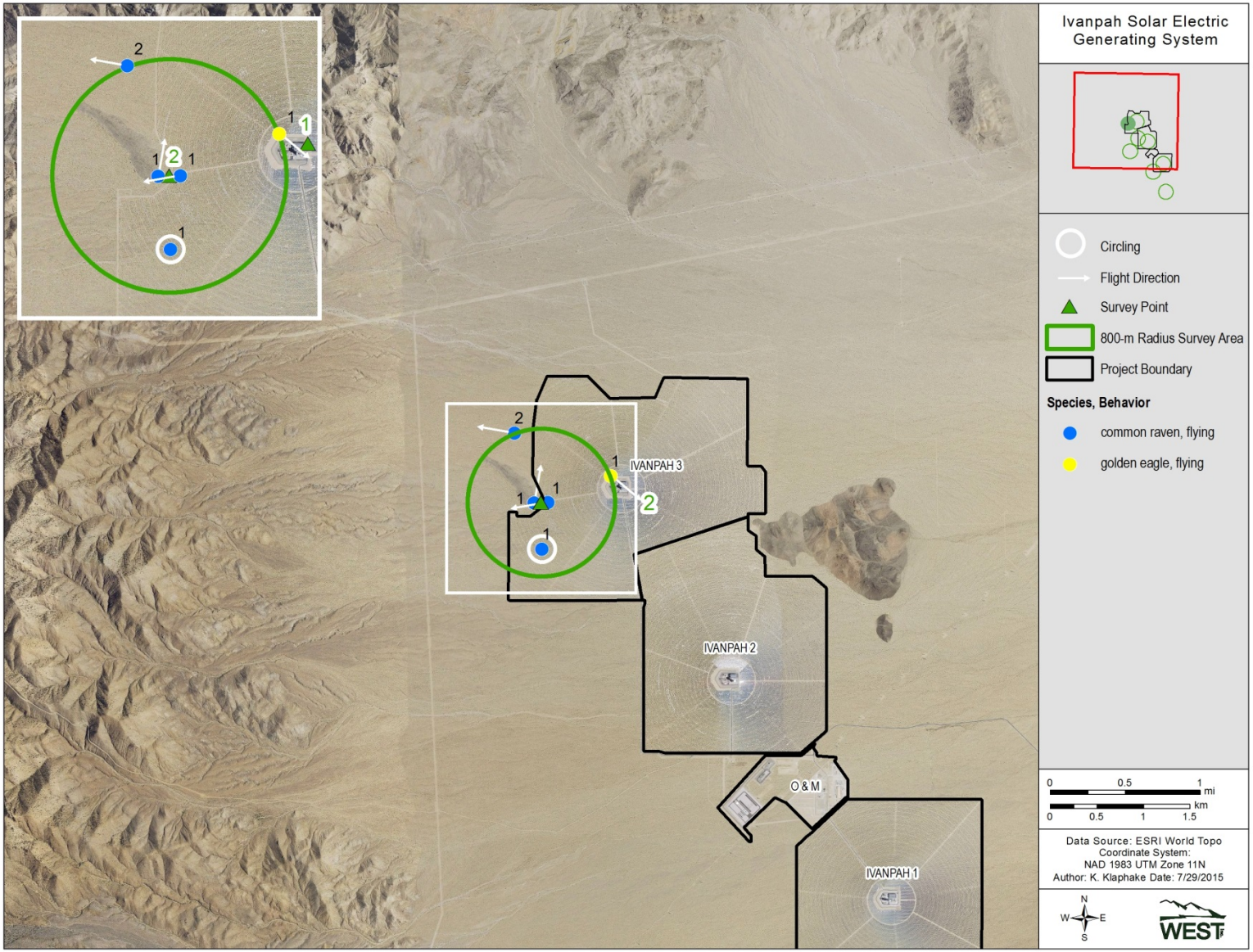

Figure 9. Raptor/Large Bird Survey Observations from Survey Point 2, 2015 Spring.

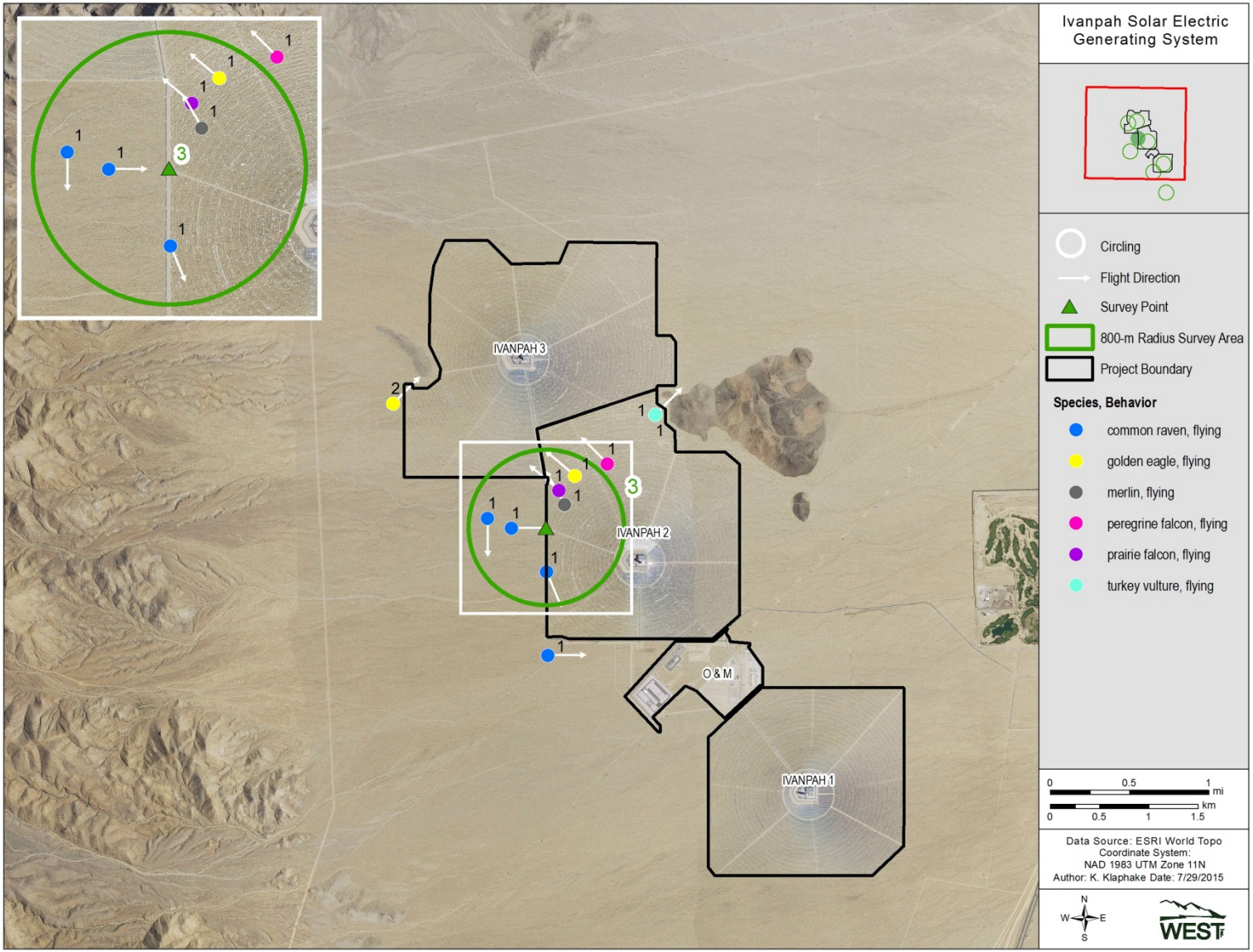

Figure 10. Raptor/Large Bird Survey Observations from Survey Point 3, 2015 Spring.

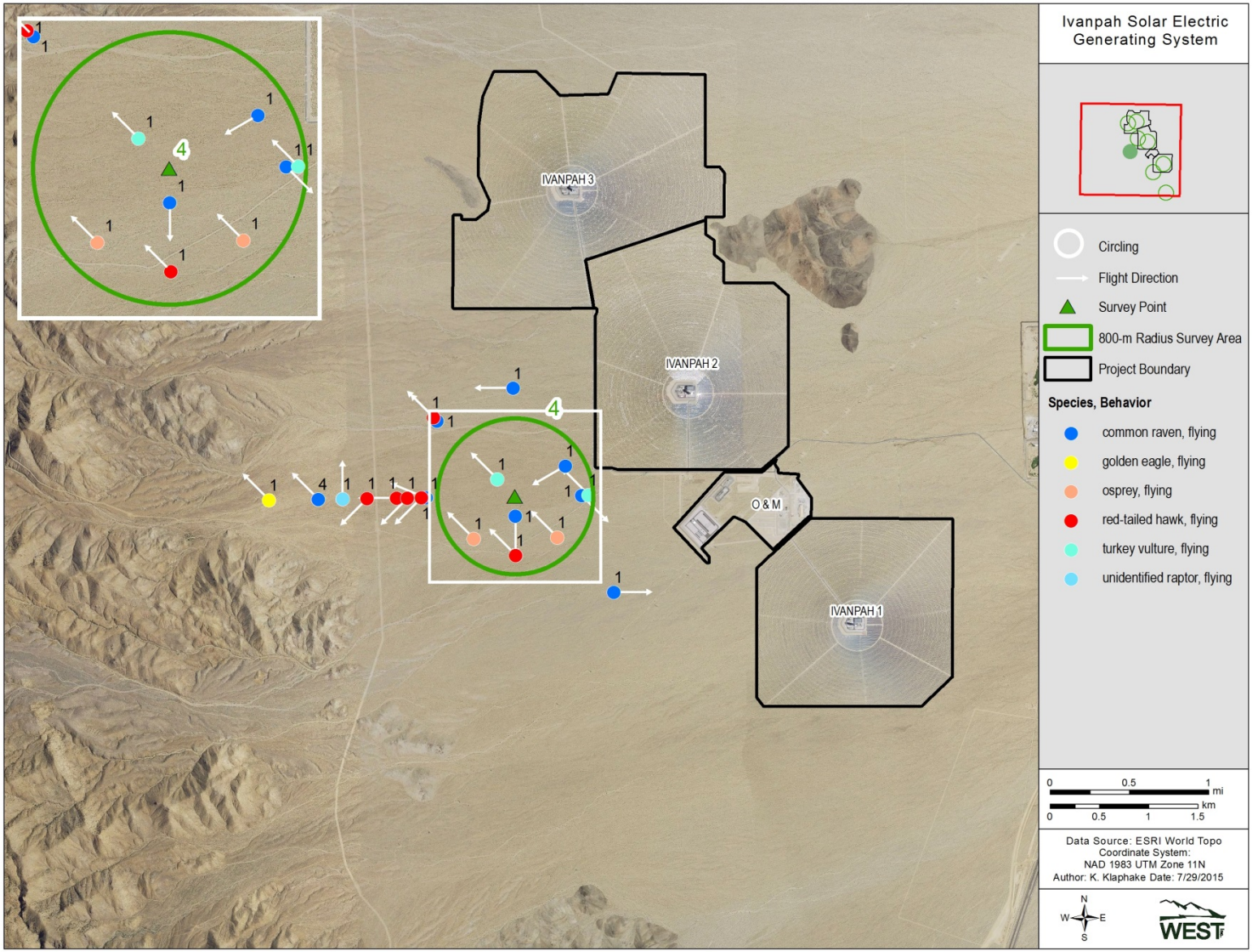

Figure 11. Raptor/Large Bird Survey Observations from Survey Point 4, 2015 Spring.

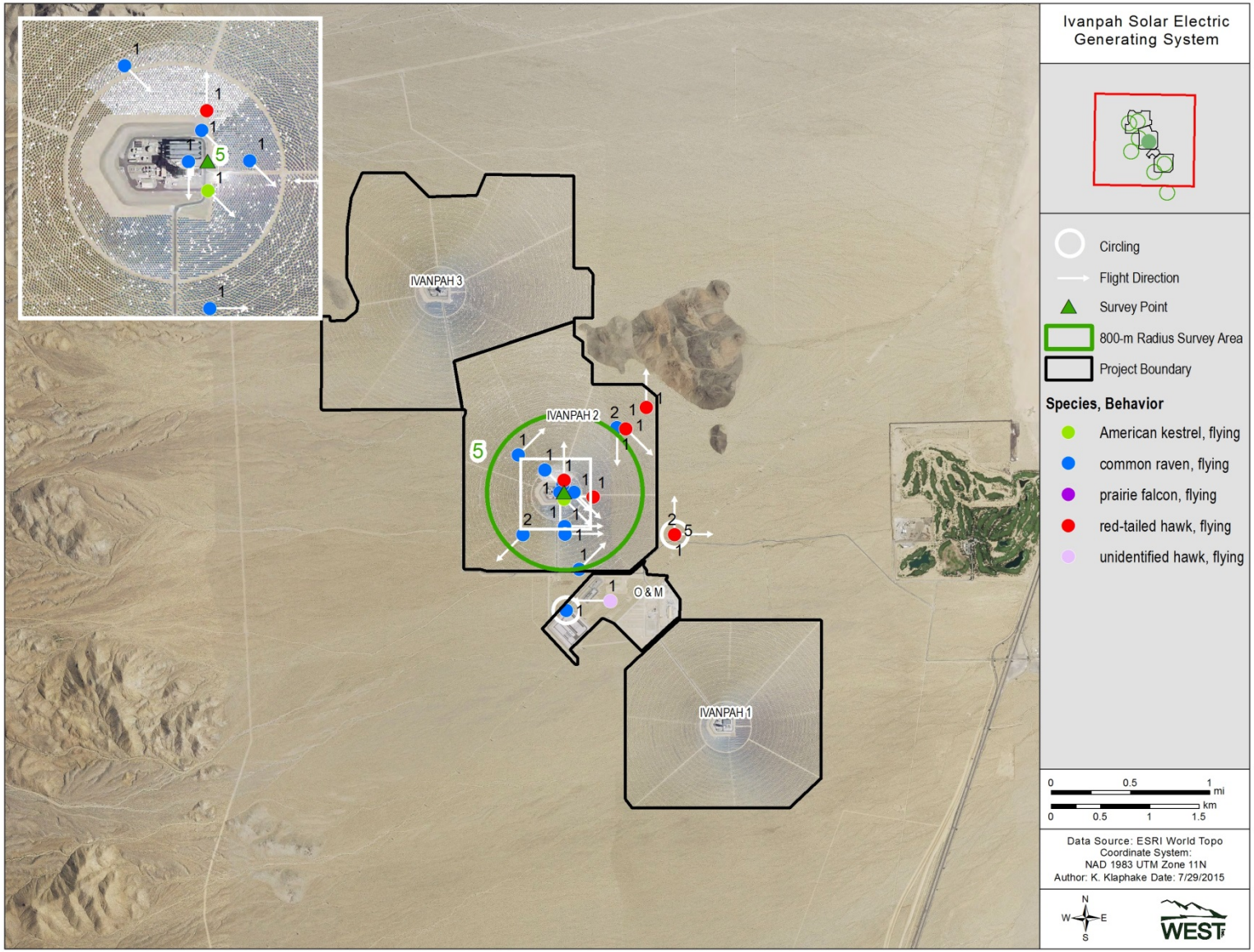

Figure 12. Raptor/Large Bird Survey Observations from Survey Point 5, 2015 Spring.

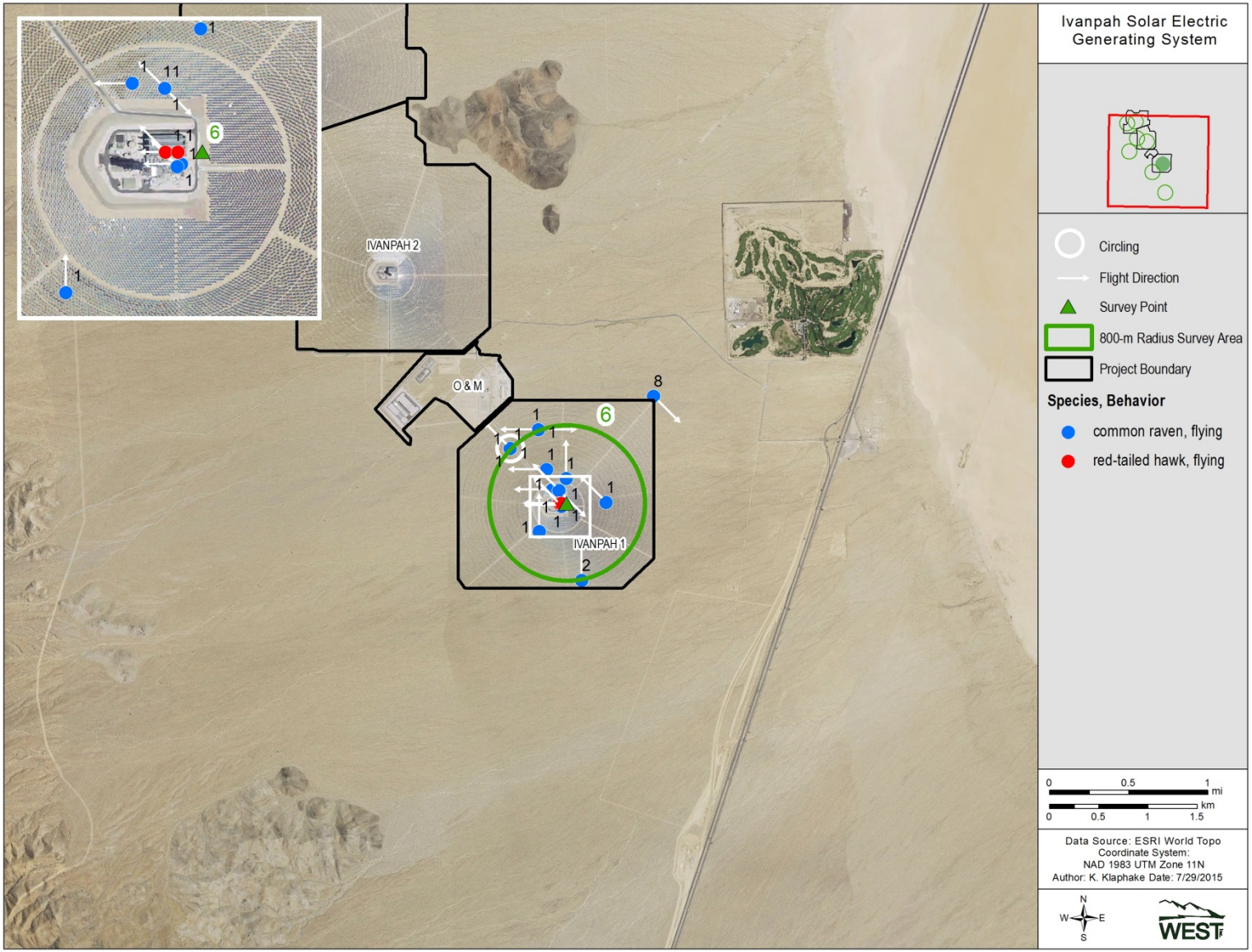

Figure 13. Raptor/Large Bird Survey Observations from Survey Point 6, 2015 Spring.

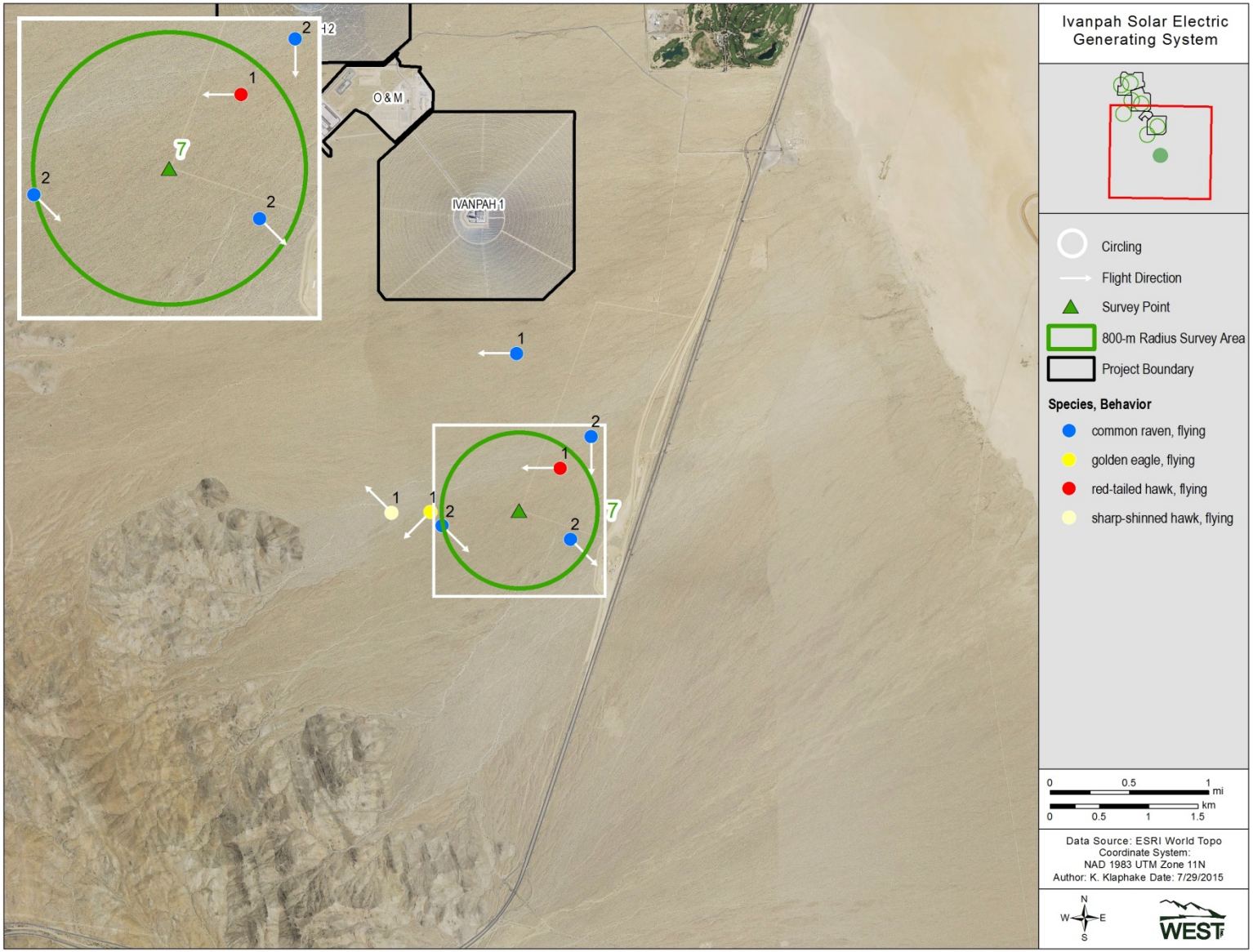

Figure 14. Raptor/Large Bird Survey Observations from Survey Point 7, 2015 Spring.

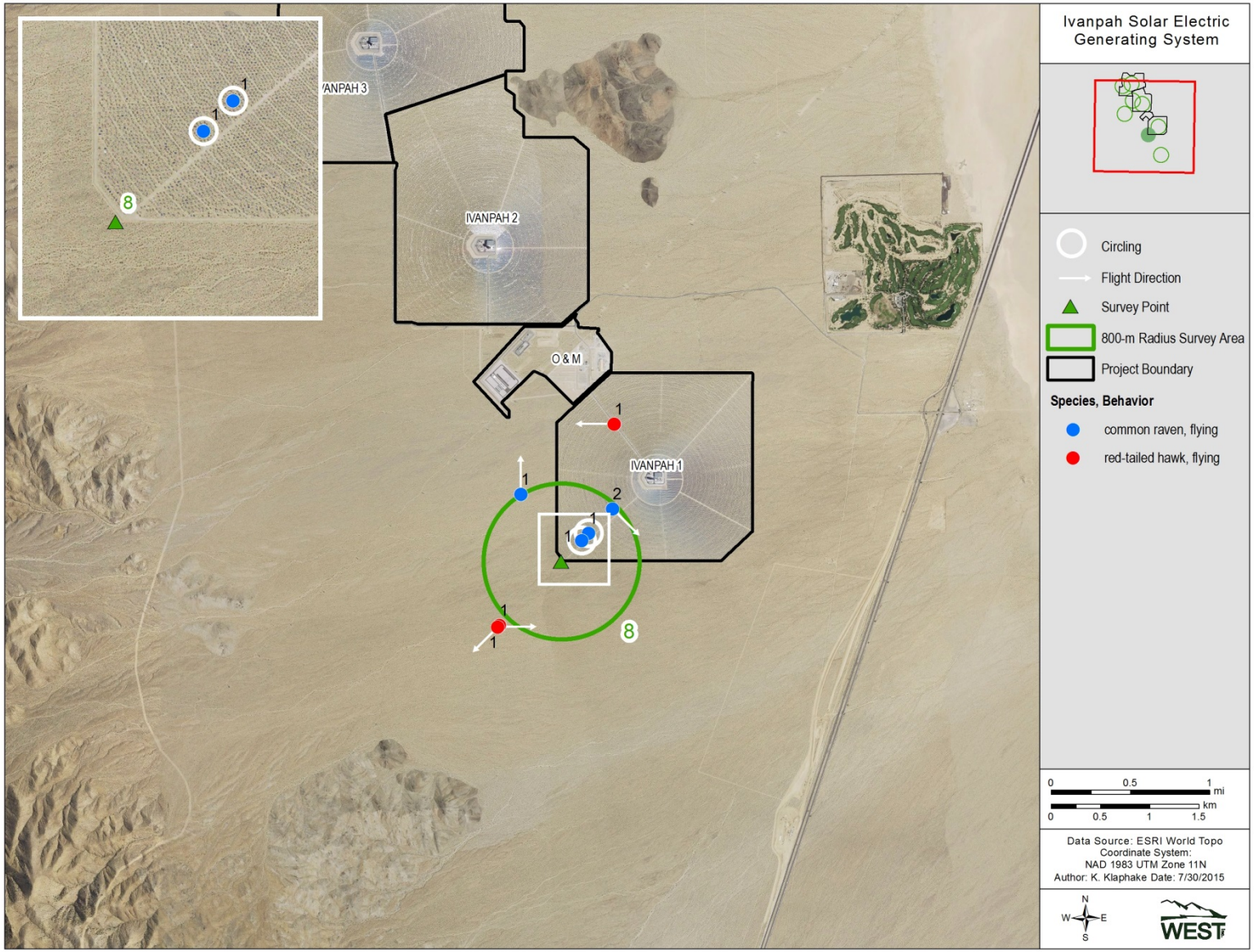

Figure 15. Raptor/Large Bird Survey Observations from Survey Point 8, Spring 2015.

Section 4.0 Monitoring Results

4.1 Summary of Avian Detections

The average search interval was 9.05 days (range 1 to 37, median 7 days) during the 2015 spring season for the three solar units. Variation in search interval was anticipated to occur due to the transition from a 21-day search interval to a 7-day search interval between seasons of differing length. During the 2015 spring season, a total of 185 avian detections (including injured birds and incidentals) of 51 identified species (Table 8) were recorded. Approximately 68% of detections were small passerines, with 36% being other types of birds; 2% could not be identified to a lower taxonomic level. The most numerous detection of an identified species was yellow-rumped warbler followed by mourning dove.

Table 8. Number of Individual Bird Detections, by Species, 2015 spring season.

Common Name	Scientific Name	Injuries	Fatalities	Small passerine?
yellow-rumped warbler	*Setophaga coronata*	2	33	Yes
unidentified passerine		0	18	Yes
mourning dove	*Zenaida macroura*	0	14	No
calliope hummingbird	*Selasphorus calliope*	0	12	No
black-throated sparrow	*Amphispiza bilineata*	0	7	Yes
Wilson's warbler	*Cardellina pusilla*	0	6	Yes
rufous hummingbird	*Selasphorus rufus*	0	6	No
greater roadrunner	*Geococcyx californianus*	0	5	No
unidentified hummingbird		0	4	No
Costa's hummingbird	*Calypte costae*	0	4	No
northern rough-winged swallow	*Stelgidopteryx serripennis*	2	4	Yes
lesser nighthawk	*Chordeiles acutipennis*	0	3	No
horned lark	*Eremophila alpestris*	0	3	Yes
MacGillivray's warbler	*Geothlypis tolmiei*	0	3	Yes
orange-crowned warbler	*Oreothlypis celata*	1	3	Yes
unidentified swallow		0	2	Yes
green-winged teal	*Anas crecca*	0	2	No
black-chinned hummingbird	*Archilochus alexandri*	0	2	No
Savannah sparrow	*Passerculus sandwichensis*	0	2	Yes
eared grebe	*Podiceps nigricollis*	0	2	No
ruby-crowned kinglet	*Regulus calendula*	0	2	Yes
yellow warbler	*Setophaga petechia*	1	2	Yes
Townsend's warbler	*Setophaga townsendi*	0	2	Yes
Brewer's sparrow	*Spizella breweri*	0	2	Yes
chipping sparrow	*Spizella passerina*	0	2	Yes
western meadowlark	*Sturnella neglecta*	0	2	Yes
violet-green swallow	*Tachycineta thalassina*	0	2	Yes

Common Name	Scientific Name	Injuries	Fatalities	Small passerine?
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	2	Yes
white-crowned sparrow	*Zonotrichia leucophrys*	0	2	Yes
Cooper's hawk	*Accipiter cooperii*	0	1	No
American wigeon	*Anas americana*	0	1	No
cinnamon teal	*Anas cyanoptera*	0	1	No
verdin	*Auriparus flaviceps*	0	1	Yes
cactus wren	*Campylorhynchus brunneicapillus*	0	1	Yes
rock pigeon	*Columba livia*	0	1	No
common raven	*Corvus corax*	0	1	No
snowy egret	*Egretta thula*	0	1	No
American kestrel	*Falco sparverius*	1	1	No
Bullock's oriole	*Icterus bullockii*	0	1	Yes
cliff swallow	*Petrochelidon pyrrhonota*	0	1	Yes
black-headed grosbeak	*Pheucticus melanocephalus*	0	1	Yes
western tanager	*Piranga ludoviciana*	1	1	Yes
blue-gray gnatcatcher	*Polioptila caerulea*	0	1	Yes
black-tailed gnatcatcher	*Polioptila melanura*	0	1	Yes
lesser goldfinch	*Spinus psaltria*	0	1	Yes
tree swallow	*Tachycineta bicolor*	0	1	Yes
house wren	*Troglodytes aedon*	0	1	Yes
American robin	*Turdus migratorius*	0	1	Yes
white-winged dove	*Zenaida asiatica*	0	1	No
American coot	*Fulica americana*	1	0	No
barn swallow	*Hirundo rustica*	1	0	Yes
lazuli bunting	*Passerina amoena*	1	0	Yes
bank swallow	*Riparia riparia*	1	0	Yes
Total		12	173	NA*

*NA – Not Applicable

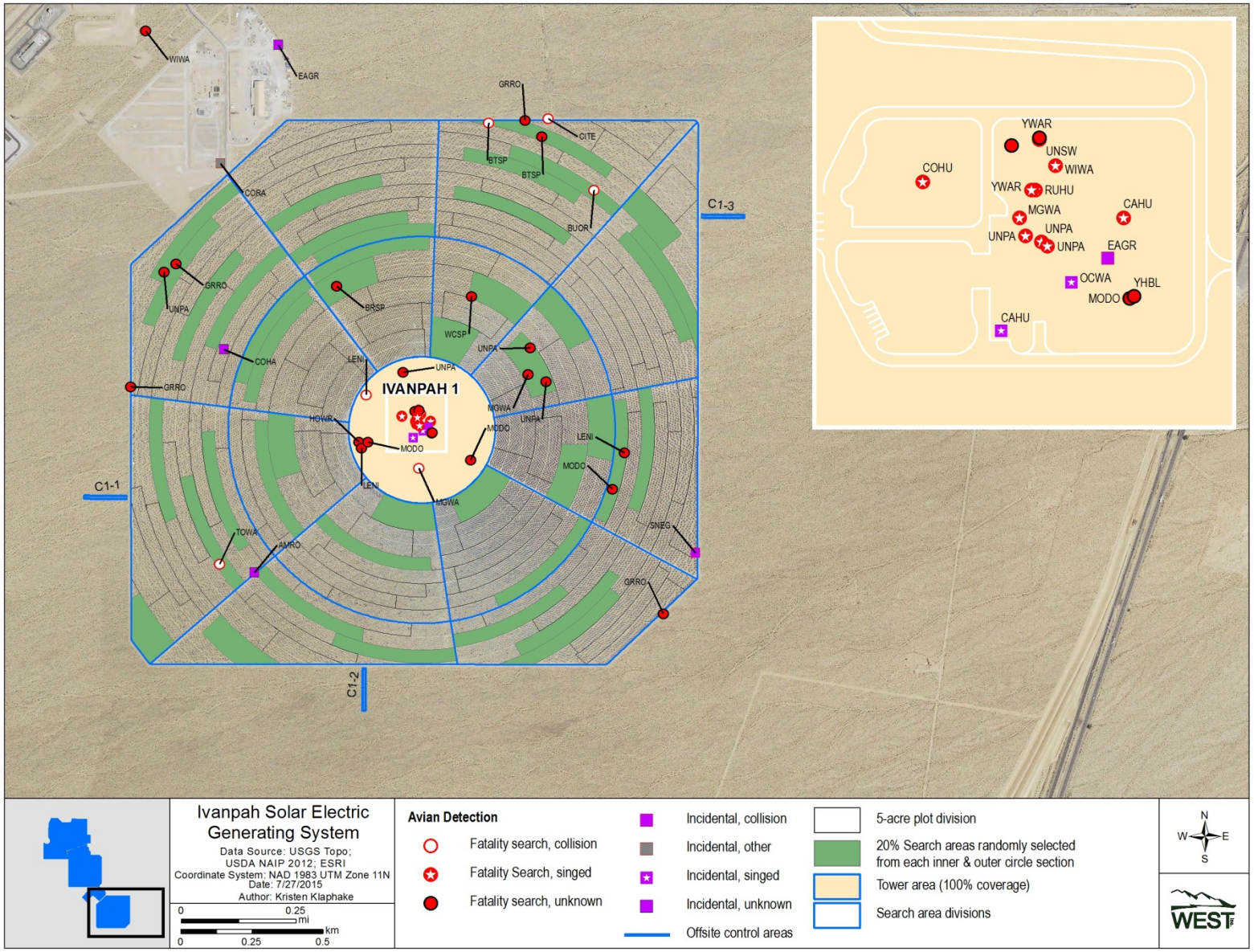

Figure 16. Ivanpah 1 Detections.

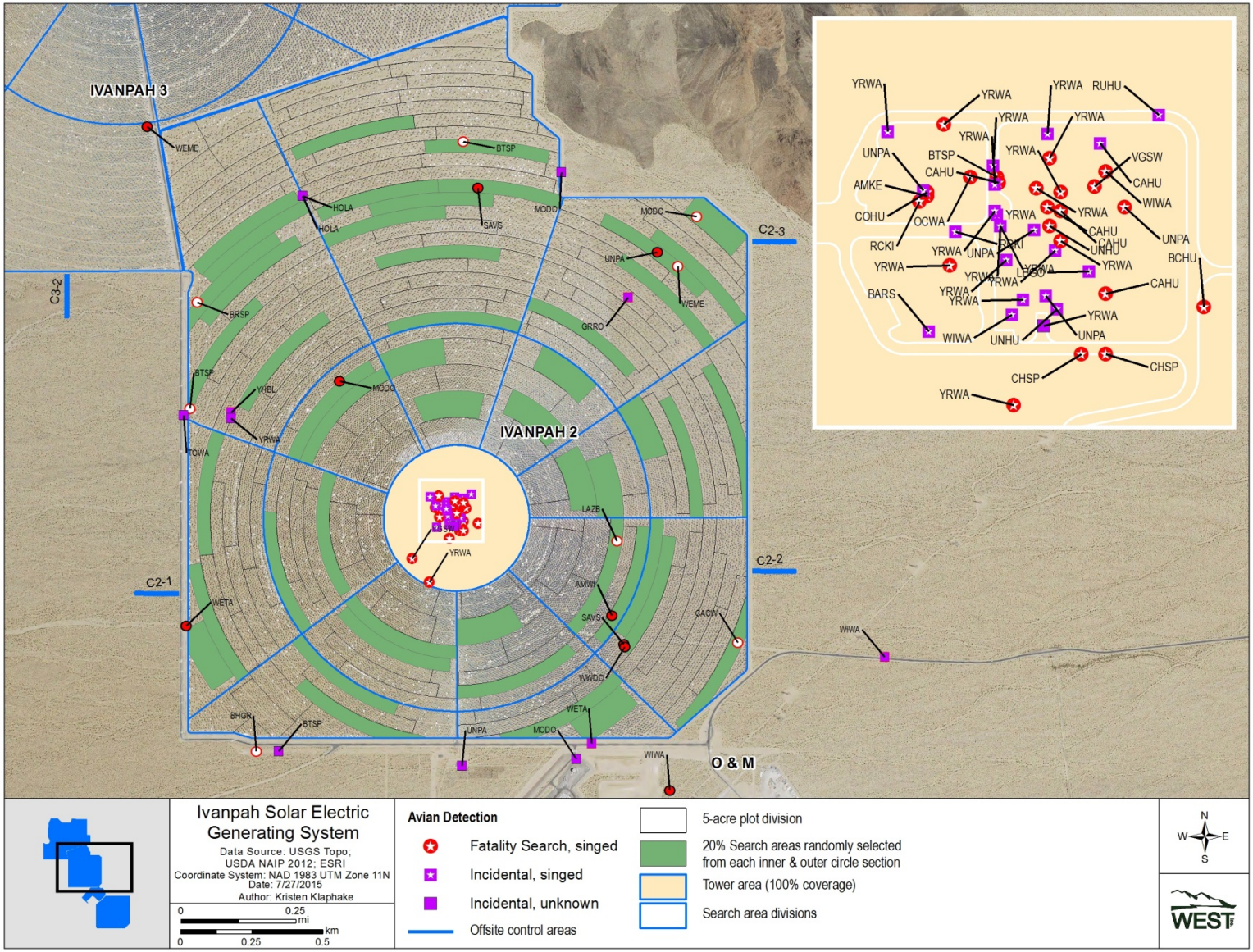

Figure 17. Ivanpah 2 Detections.

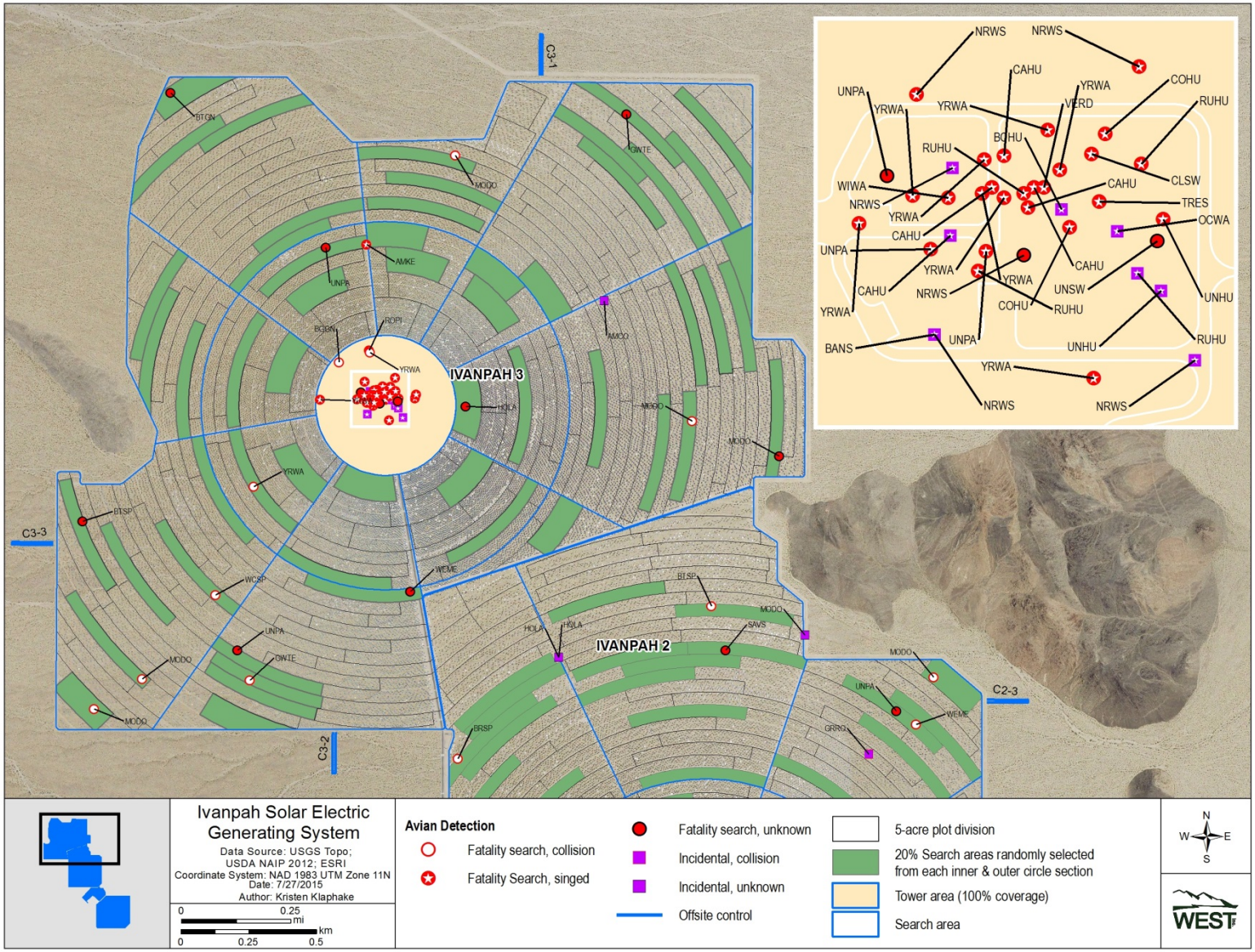

Figure 18. Ivanpah 3 Detections.

4.1.1 Temporal Patterns of Avian Detections

The number of detections reported per day varied during the 2015 spring season (Figure 19). The period from 16 March through 2 April was characterized by few detections per day with a high of 5 detections on one day. The period from 3 April through 21 May 2015 was characterized by peaks in detections with a high of 10 detections on 4 May 2015. The number of detections per day represents the accumulation of detections over the search interval minus those detected incidentally and removed between searches. Thus, to better understand if search interval or the area that was searched influences the number of detections reported per day, the tower area and heliostat area were examined separately (Figure 19). Peaks in the number of detections per day were associated with tower area searches beginning 3 April 2015. In other words, peaks in detections depended on the day a tower area was searched, and based on the 7-day search interval the short elapsed time between searches resulted in not more than 10 detections per day.

Data from BirdCast suggests that the 2015 spring season captured almost the entire period of spring migration. The BirdCast West regional migration summaries were available from 13 March – 24 May 2015. During the 2015 spring season, movements were described as light to moderate in California and Desert Southwest each week with only locally heavy movements noted 14 April 2015.

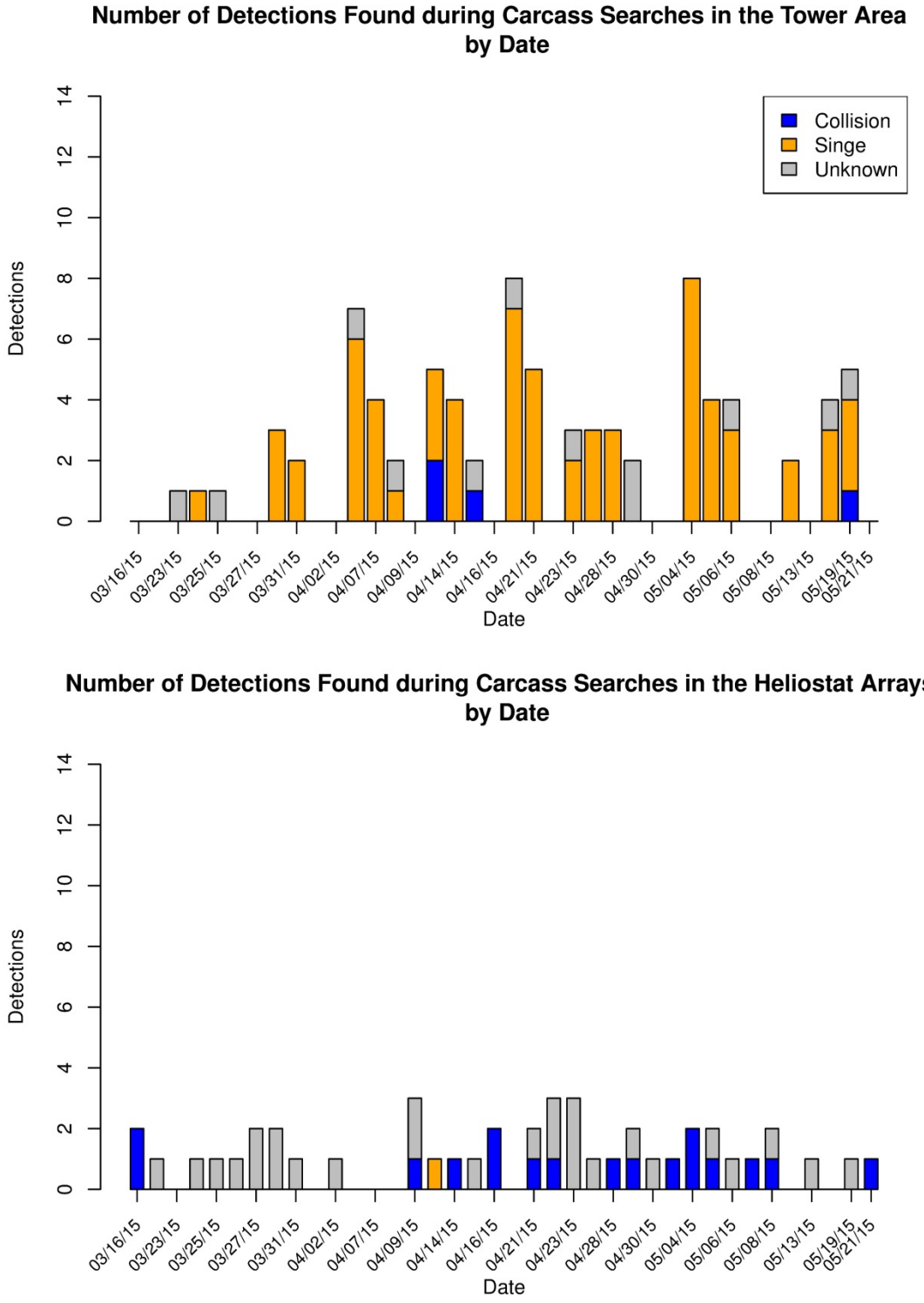

Figure 19. Number of Detections on Each Survey Date, 16 March – 24 May 2015.

Twelve injured birds were detected during the 2015 spring season (Table 9), and three were released alive off-site. One injured bird (American kestrel) is alive at a rehab facility, the Wild Wing Project in North Las Vegas, NV. As of 24 July, 2015, the bird, which showed flux effects to wing, tail, and body feathers, was improving.

Table 9. Avian Injuries Detected 16 March – 24 May 2015.

Date	Species	Age	Sex	Suspected Cause of Injury	Flux Grade	Fate
3/27/2015	northern rough-winged swallow	Adult	Unknown	Flux	2;3	Died at rehab
4/12/2015	northern rough-winged swallow	Unknown	Unknown	Flux	2;3	Died on site
4/12/2015	bank swallow	Unknown	Unknown	Flux	2;3	Died at rehab
4/13/2015	American kestrel	Adult	Male	Flux	2;3	Alive at rehab
4/20/2015	yellow-rumped warbler	Unknown	Male	Flux	2;3	Died on site
4/22/2015	orange-crowned warbler	Adult	Unknown	Flux	2;3	Died on site
4/28/2015	yellow-rumped warbler	Adult	Male	Flux	1	Died on site
4/28/2015	barn swallow	Adult	Unknown	Flux	2;3	Died on site
4/28/2015	lazuli bunting	Adult	Female	Collision	NA	Released off-site
4/30/2015	yellow warbler	Adult	Male	Flux	2;3	Died on site
5/4/2015	American coot	Adult	Unknown	Unknown	NA	Released off-site
5/8/2015	western tanager	Adult	Male	Unknown	NA	Released off-site

4.1.2 Comparison of Avian Use Survey Results to Fatality Detections

Whereas 41 bird species were recorded during avian use surveys, 50 identifiable species were recorded as detections during fatality monitoring. Comparison of the most frequently observed species on the avian use surveys at the heliostats to the species most frequently recorded as detections did not show a clear pattern of association. Of identified species, the most frequently observed species differed between the heliostat area and desert area with horned lark most frequently observed in the heliostat area and black-throated sparrow most frequently observed in the dessert area (Table 10). These species accounted for 1.0% or less of the avian detections in the area where they were most frequently observed. The four next most common species observed at the desert bajada survey areas were either not recorded as detections (ash-throated flycatcher, LeConte's thrasher) or accounted for less than 1.5% of detections (Brewer's sparrow, cactus wren).

Table 10. Comparison of the Most Abundant Bird Species Recorded as Detections and Recorded During Avian Use Surveys for Identified Species Only.

Detections		Avian Use Survey - Heliostats		Avian Use Survey - Desert	
Species	Percent of Total	Species	Percent of Total	Species	Percent of Total
yellow-rumped warbler	21.7	horned lark	36.4	black-throated sparrow	33.9
mourning dove	8.7	house finch	22.0	cactus wren	22.1
calliope hummingbird	7.5	black-throated sparrow	16.1	Brewer's sparrow	10.2
black-throated sparrow	4.3	common raven	6.8	Le Conte's thrasher	5.6
Wilson's warbler	3.7	American pipit	4.2	ash-throated flycatcher	5.1
rufous hummingbird	3.7	cactus wren	1.7	loggerhead shrike	4.0
northern rough-winged swallow	3.7	northern rough-winged swallow	1.7	white-crowned sparrow	2.9
greater roadrunner	3.1	American kestrel	0.8	Bewick's wren	2.1
Costa's hummingbird	2.5	barn swallow	0.8	house finch	1.9
orange-crowned warbler	2.5	house wren	0.8	verdin	1.9
lesser nighthawk	1.9	lark sparrow	0.8	common raven	1.7
horned lark	1.9	least sandpiper	0.8	blue-gray gnatcatcher	1.1
MacGillivray's warbler	1.9	loggerhead shrike	0.8	white-throated swift	1.0
yellow warbler	1.9	mourning dove	0.8	yellow-rumped warbler	1.0

4.1.3 Summary of Bat Detections

Three bats representing one identifiable species and one unidentified species were detected during the 2015 spring season. One bat was detected on 14 April 2015, and two bats were detected on 21 April 2015. One canyon bat was located in the Unit 2 ACC building, and one canyon bat was found immediately outside of the Unit 2 ACC building. The unidentifiable bat was found in the Unit 2 ACC building as well. The bats were detected prior to the installation of the deterrence measure at the Unit 2 ACC, and no bats were detected after installation of the bat deterrence measure. Given the few detections of bats, they are not discussed further.

4.2 Locations of Avian Detections

4.2.1 Detections by Project Area

During 2015 spring season, of the 185 total detections, 118 detections (63.8%) were recorded at the tower area, 52 detections (28.1%) were recorded over the much larger heliostat area, 7 (3.8%) of the detections were located at the perimeter fence, 5 detections were recorded outside of the survey areas on other project lands (2.7%), and 3 detections were recorded within the survey areas associated with the collector line (1.6%; Table 11). No detections were recorded in the offsite transects.

Table 11. Locations of Bird Detections, 16 March – 24 May 2015.

Location	Carcasses	Injuries	Percent of Total
Tower Area	110	8	63.8%
Heliostat Area	48	4	28.1%
Fenceline	7	0	3.8%
Collector Line	3	0	1.6%
Other Project Lands	5	0	2.7%
Total	173	12	100.0%

Table 12. Locations of Bird Detections by Cause, 16 March – 24 May 2015.

Location	Singeing	Collision	Electrocution	Unknown	Total
Tower Area	100	5	0	13	118
Heliostat Area	1	20	0	31	52
Fenceline	0	2	0	5	7
Collector Line	0	1	0	2	3
Other Project Lands	0	1	1	3	5
Total	101	29	1	54	185

4.3 Cause of Injury or Fatality

The following section describes the number of detections with evidence of singeing or collision; the number from other known causes; the number for which cause of injury or fatality is unknown; and the spatial distributions of detections with these causes. Figure 20 shows the distribution of detections by cause.

4.3.1 Singeing Effects

Of the 185 avian detections during the 2015 spring season, 101 detections (54.6%) showed signs of singed feather damage, and 99% of singed detections were recorded in the tower area (Table 12a). A single detection was found outside of the tower area, an injured American kestrel located in the heliostat arrays of Unit 3.

4.3.2 Collisions

Of the 185 avian detections, evidence of collision was observed in the case of 29 (15.7%), and collision detections were found in all areas monitored with 69% located in the heliostat area. 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).

4.3.3 Other Known Causes

One avian detection (less than 1.0% of all detections) without evidence of singeing or collision effects was determined to have been electrocuted, according to carcass condition and proximity to a power line that is not associated with the Project. The juvenile common raven was found with burns on the feet, throughout the ventral body, and on the bill; exit wounds characteristic of electrocution were found on the feet. Feathers did not show signs of singeing from highly concentrated flux.

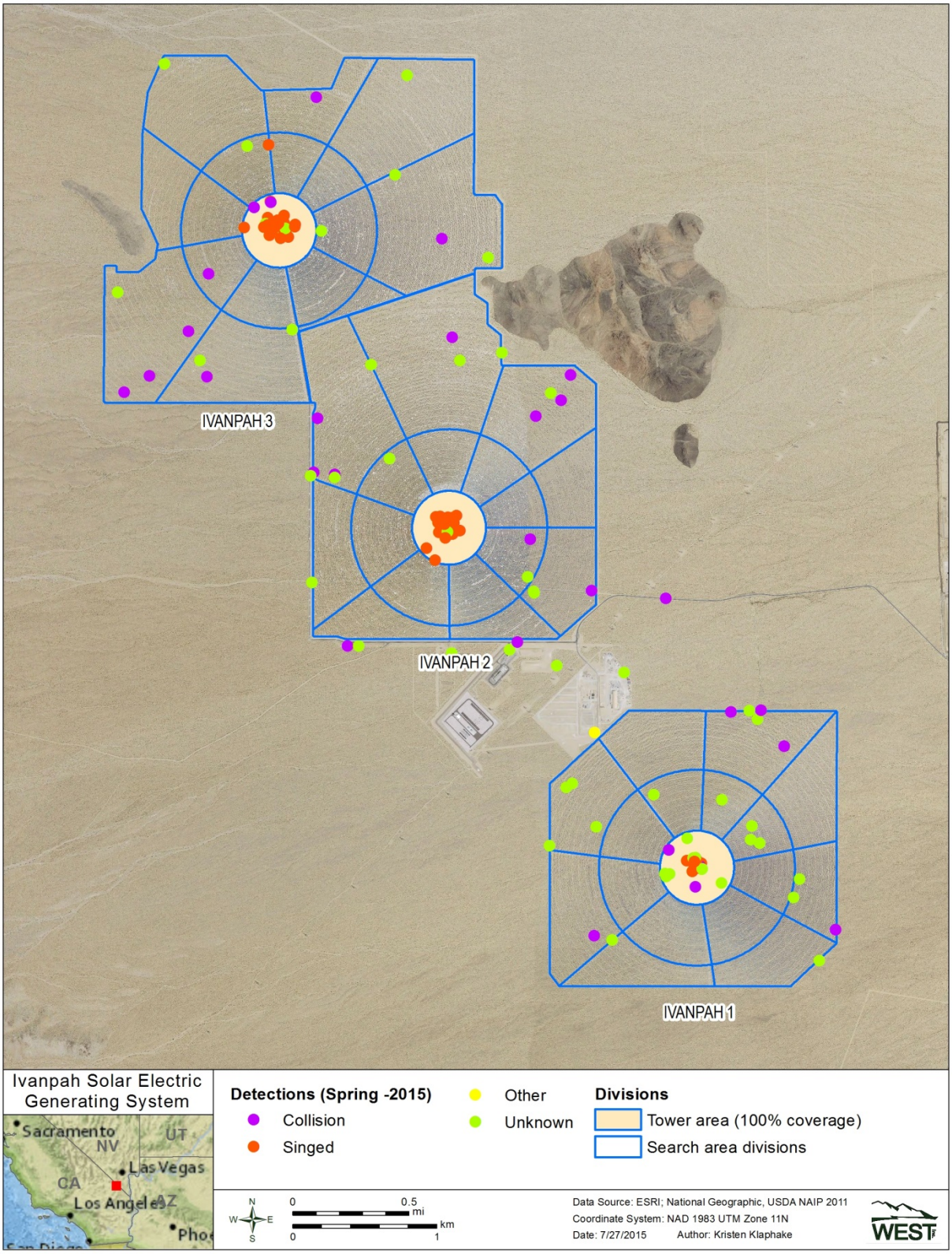

Figure 20. Locations of Singed and Unsinged Detections within Solar Units.

4.3.4 Detections of Unknown Cause

Of the 185 avian detections, evidence of singeing, collision, or other cause could not be assigned for 54 detections (29.1%; Table 12a). Per the Plan section 2.1, these detections cannot be presumed or presumed without a reasonable doubt to be caused by the facility; see Section 6.2 of this report for further discussion. Of the unknown cause detections, 31 (57.4%) were recorded in the heliostat area; 13 (24.1%) were recorded in the tower area, and the remaining 10 (18.5%) were found at the fenceline, other project lands, and the collector line. Unknown cause detections showed no external evidence of collision effects, and microscopic analysis did not indicate signs of singeing.

4.4 Types of Detections

Forty-seven of the 185 detections (25.4%) consisted only of feather spots (Table 13a). Over 71% of the detections located at the fenceline were feather spots, and feather spots accounted for over 40% of detections at the inner and outer heliostats. Percent of the detections that were feather spots was lower in the power block (16.9%), and at other project lands (20%). Evidence of singeing was noted through direct and microscopic examination on 10 of these 47 feather spots; evidence of collision (i.e., an impact imprint on a nearby mirror) was noted in the case of 4 other feather spots. Otherwise, the causes of the feather spots for the other 33 detections are unknown (Table 13b).

Table 13a. Percent Composition Feather Spots to Carcasses Relative to Site Locations.

Location	Carcasses	Feather Spot	Total	Percent Feather Spot*
Tower Area	98	20	118	16.9%
Heliostat Area	31	21	52	40.4%
Fenceline	2	5	7	71.4%
Collector Line	3	0	3	0%
Other Project Lands	4	1	5	20%
Total	138	47	185	25.4%

*NA = Not applicable

Table 13b. Percent Composition Feather Spots to Carcasses Relative to Cause.

Cause	Carcasses	Feather Spots	Total Detections	Percent Feather Spot*
Collision	25	4	29	13.8%
Singed	91	10	101	9.9%
Electrocution	1	0	1	0%
Unknown	21	33	54	61.1%
Total	138	47	185	25.4%

*Total percent feather spot is total feather spots divided by total detections.

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 total estimate for the entire facility is presented separately for fatalities with evidence of singeing or collision effects, or for detections in the ACC buildings, and fatalities of unknown cause. Following presentation of the total fatality estimates, estimates are provided separately for the tower area, heliostat area, and fenceline.

5.1 Estimating Model Parameters

5.1.1 Carcass persistence Trials

A total of 47 carcass persistence trials were conducted during the 2015 spring monitoring season, including 32 small birds and 15 large birds distributed throughout the facility. Consistent with previous seasons, scavengers included common ravens (*Corvus corax*, N = 29), desert kit fox (*Vulpes macrotis*; N=14), white-tailed antelope squirrels (*Ammospermophilus leucurus*; N=5), greater roadrunner (*Geococcyx californianus*; N=2), desert woodrat (N=3), and ants (N=1). In four instances no scavenger was captured on film. Carcass persistence ranged from less than one day in the case of 10 small carcasses, to the full six-week trial length in the case of all 15 large carcasses and 4 small bird carcasses (Figures 21 and 22).

Carcass persistence data from 87 trials performed during the first year of monitoring (29 October 2013 – 20 October 2014) were also used to model carcass persistence time. These trials included 30 large bird carcasses and 57 small bird carcasses. Carcasses were placed at the power block, in the inner HD heliostats and inner and outer heliostat segments, along the fenceline, under the collector line, and on offsite transects. Scavenger species included common ravens (N=22), desert kit fox (*Vulpes macrotis*; N=15), white-tailed antelope squirrels (*Ammospermophilus leucurus*; N=11), greater roadrunner (*Geococcyx californianus*; N=1), turkey vulture (N=1), and an unidentified canid (N=1). For the remaining 27 scavenged carcasses (six carcasses were not scavenged), the scavenger species was not captured on camera. Carcass persistence ranged from less than one day, in the case of 15 carcasses (one large and 14 small), to a full six-week trial period in the case of the 32 carcasses (25 large and seven small) whose remains persisted throughout the trial.

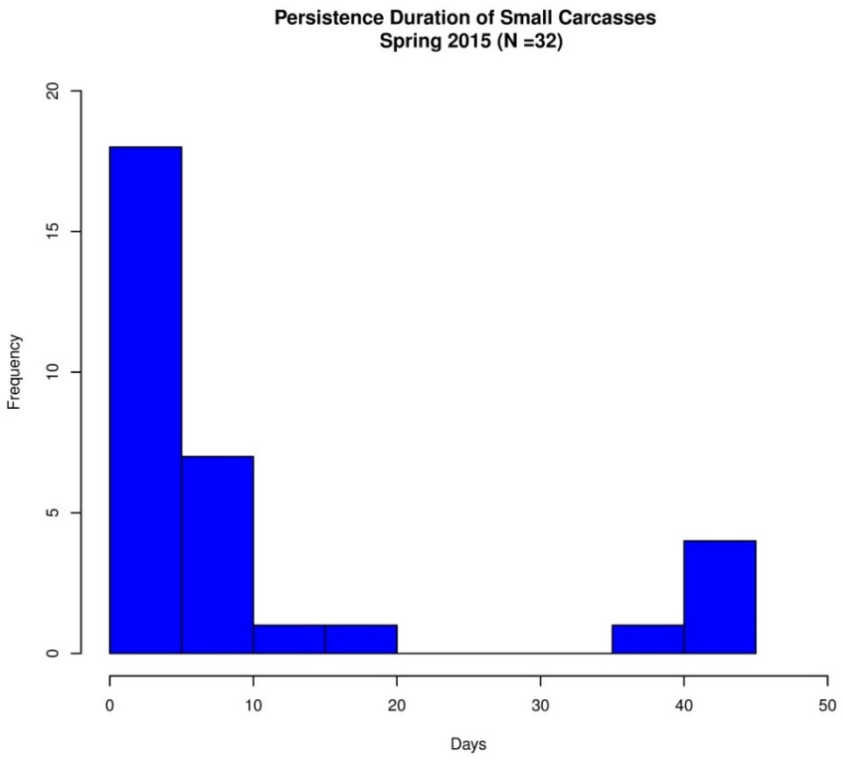

Figure 21. Persistence Durations for Small Carcasses Placed for Carcass Persistence Trials.

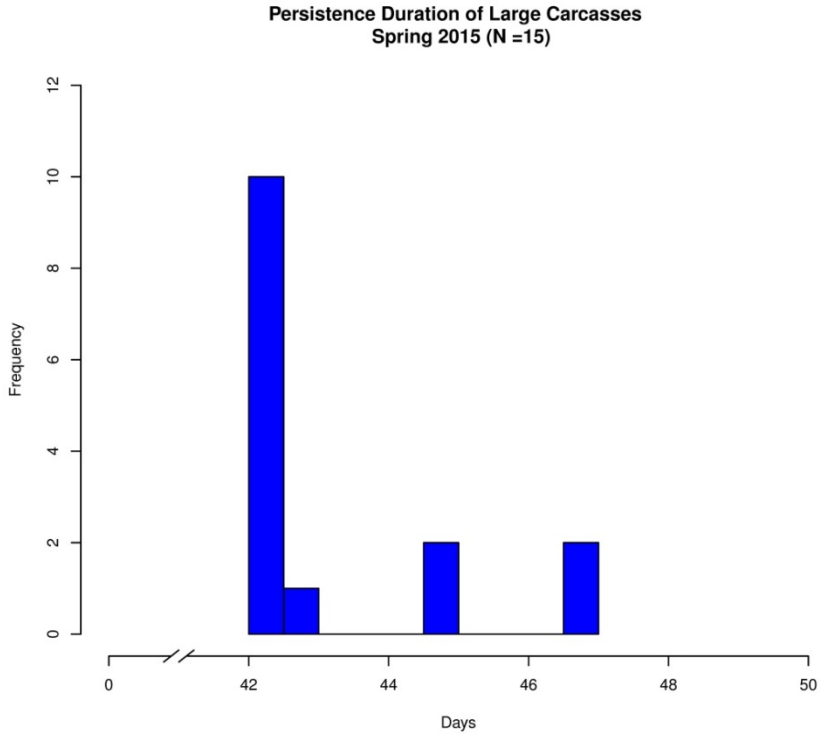

Figure 22. Persistence Durations for Large Carcasses Placed for Carcass Persistence Trials.

5.1.2 Model Selection for Carcass Persistence Distribution

In addition to the data collected during 2015 spring, data from 87 trials performed during the first year of monitoring (29 October 2013 – 20 October 2014) were included to model carcass persistence time for this 2015 spring report. For a detailed description of carcass persistence trial methods used prior to the 2015 spring monitoring season, see the fall monitoring report (H.T. Harvey & Associates 2015a).

In contrast to the first year of reporting, two separate carcass persistence models were fit to this dataset: one for small birds and one for large birds. The cumulative dataset, with 5 seasons of data suggests that the removal process for small birds and large birds is markedly different. Namely, large birds consistently persist for long periods of time (typically greater than six weeks), whereas small birds tend to be removed with days or hours, and exhibit seasonal variability. Fitting separate models by size allows for more flexibility, enabling different distributions with different shapes to be fit to the small bird and large bird data, respectively. As small bird and large bird carcasses are being treated separately, the sample size for each model is necessarily reduced; however, given the large dataset accumulated over six seasons of monitoring, the potential loss in precision is negligible, especially compared to the potential increase in accuracy.

Based on the carcass persistence data from 2015 spring, and the first year of study, 16 survival models were compared for the small bird and large bird datasets, respectively. Models were compared for relative explanatory power using the corrected Akaike information criterion (AICc) score (Akaike 1973), as suggested in Huso (2010). AICc provides a relative measure of model fit and parsimony among a selection of candidate models. Season was considered as a possible covariate due to cyclical variation in scavenging pressure and environmental conditions associated with seasons. Year was also incorporated as a covariate to assess whether respective seasons could be pooled across the first two years (i.e. combine 2014 spring with 2015 spring persistence trial results). At the conclusion of the first year of monitoring the location of a carcass (unvegetated tower area or the vegetated areas in heliostat arrays, along fence line, and under collector line) was not present in the top models for carcass persistence. Given this historical precedent in the data, carcass location was not included as a covariate for this report (H.T. Harvey and Associates 2015b).

The model with lowest AICc is typically chosen as the "best-fit" model relative to other models tested; however, any model within two AICc point of the best model is considered strongly supported (Burnham and Anderson 2004). For small birds the loglogistic and lognormal models that included season, season and year, and intercept only, had ΔAICc values ≤ 2; for large birds, the exponential, Weibull, loglogistic, and lognormal models with intercept only had ΔAICc values ≤ 2 (Tables 14a, b). Ultimately, a loglogistic model with season and year covariates was chosen for small birds, and an lognormal model with no covariates was chosen for large birds. Thus, the selected model for small birds can be interpreted to treat as separate the persistence probability 2014 and 2015 spring. For large birds, the top model does not have any temporal covariates, and thus uses all large bird data collected to date to estimate persistence probability. The chosen models predicted 50.1% of small carcasses persisted for a standard 7 day search interval in 2015 spring; and 96.8% of large bird carcasses persisted for a standard 7 day search interval.

Table 14a. AICc Values for Small Bird Carcass Persistence Models

Small Bird Trials			
Covariates	Distribution	AICc	Δ AICc
Year + Season	loglogistic	476.97	0
Year + Season	lognormal	477.23	0.26
Intercept	lognormal	477.81	0.84
Intercept	loglogistic	478.73	1.76
Season	loglogistic	478.8	1.83
Season	lognormal	478.89	1.92
Year + Season	weibull	481.07	4.1
Season	weibull	483.2	6.23
Intercept	weibull	483.6	6.63
Year + Season + Year*Season	loglogistic	484.22	7.25
Year + Season + Year*Season	lognormal	484.49	7.52
Year + Season + Year*Season	weibull	488.33	11.36
Year + Season	exponential	534.47	57.5
Season	exponential	539.49	62.52
Year + Season + Year*Season	exponential	541.54	64.57
Intercept	exponential	547.9	70.93

Table 14b. AICc Values for Large Bird Carcass Persistence Models

Large Bird Trials			
Covariates	Distribution	AICc	Δ AICc
Intercept Only	lognormal	70.02	0
Intercept Only	exponential	70.11	0.09
Intercept Only	weibull	70.16	0.14
Intercept Only	loglogistic	70.17	0.15
Year + Season	exponential	72.99	2.97
Season	lognormal	73.39	3.37
Year + Season	lognormal	73.47	3.45
Year + Season	loglogistic	73.71	3.69
Year + Season	weibull	73.75	3.73
Season	exponential	73.77	3.75
Season	loglogistic	74.09	4.07
Season	weibull	74.33	4.31
Year + Season + Year*Season	exponential	81.45	11.43
Year + Season + Year*Season	lognormal	82.41	12.39
Year + Season + Year*Season	loglogistic	82.64	12.62
Year + Season + Year*Season	weibull	82.68	12.66

5.1.3 Searcher Efficiency Trials

During the 2015 spring monitoring season, a total of 100 searcher efficiency trials (43 small birds, 30 large birds, and 27 feather spots) were conducted. Of the 100 trial carcasses placed, 84 (28 small carcasses, 29 large carcasses, and 27 feather spots) were available to be found; 16 carcasses (15 small carcasses, 1 large carcass, and 0 feather spots) were removed from the trial location before searchers had an opportunity to detect the carcass.

An additional 179 searcher efficiency trials from the first year of study were included in searcher efficiency model building. Of 179 trials from the first year of monitoring, 168 were not removed and thus available to be found by a searcher. The top searcher efficiency models from the full first year of monitoring included size and project area (unvegetated tower area versus the vegetated areas in heliostat fields, along fence lines, and under collector line) covariates, but not season. Given the precedent set by the first year of monitoring, season was not explicitly included as a covariate in candidate searcher efficiency models; however, due to personnel changes which occurred at the conclusion of the 2014 – 2015 winter season, it was necessary to measure potential differences in searcher efficiency between new personnel and original personnel. Therefore, a "year" covariate was included in candidate models to capture any differences between personnel groups.

The best model for searcher efficiency included project area (disaggregated to vegetated and unvegetated) and carcass size with an AICc value 1.06 points lower than the second best model that included size, project area, and year (Table 15). Thus, the most supported searcher efficiency model included a combination of project area (unvegetated tower area and vegetated heliostat arrays, along fence line, and under collector line) and carcass size. The model including a year covariate (i.e. different field staff) was within 2 AICc points of the best model; however, evaluation of additional model diagnostics revealed that the 'year' covariate was not significantly different from zero (*p-value* = 0.31). As a result, the model including size and project area was chosen and searcher efficiency data were pooled for all seasons and personnel groups but were separated by project area and carcass size. Table 16 provides the searcher efficiency rates.

Overall searcher efficiency rates applied to 2015 summer detection data were higher in the unvegetated areas including the tower area. In unvegetated areas, searcher efficiency was 65% for small birds, 79% for large birds, and 65% for feather spots. In the vegetated areas in the heliostat fields and offsite transects, along fence lines, under the collector line, searcher efficiency was 41% for small birds, 59% for large birds, and 34% for feather spots.

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Table 15. Covariates, AICc Values, and ΔAICc values for Searcher Efficiency Models of Carcasses. Data consist of all searcher efficiency trials for carcasses from the initiation of trials through 24 May 2015.

Covariates	AICc	Δ AICc
Size + Project Area	332.86	0
Size + Project Area + Year	333.92	1.06
Project Area	338.83	5.97
Project Area + Year	340.33	7.47
Size	344.43	11.57
Size + Year	346.49	13.63
Intercept Only	350.35	17.48
year	352.25	19.39

Table 16. Human Searcher Efficiency Values for Size and Project Area Categories.

Size	Project Area	Found	Available	Placed	Estimated Searcher Efficiency (90% CI)
Feather spot	Tower area (Unvegetated)	21	35	35	0.58 (0.47-0.68)
Large bird	Tower area (Unvegetated)	23	31	31	0.79 (0.71-0.87)
Small bird	Tower area (Unvegetated)	25	37	45	0.65 (0.54-0.75)
Feather spot	Heliostat area (Vegetated)	19	58	58	0.34 (0.25-0.44)
Large bird	Heliostat area (Vegetated)	28	45	51	0.59 (0.49-0.69)
Small bird	Heliostat area (Vegetated)	18	46	59	0.41 (0.31-0.51)

5.2 Fatality Estimates of Known Causes for 2015 Spring Monitoring

Fatality estimates were calculated separately for the tower area (power block and inner HD heliostats), heliostat area, collector line, and fencelines (unit perimeter and CLA fences). Note that estimates are not provided for factor combinations with five or fewer detections; thus, marginal totals (e.g. total singed, total known cause in the heliostat area, etc.) for the tables below may not reflect the sum of estimates within a given row or column (and are generally higher). For example, no estimate is provided for collision related mortality in the tower area, because there were fewer than 5 collision attributed detections (i.e. "N ≤ 5"). However, the total tower area estimate is greater than the estimate for singed fatalities in the tower area because the collision related detections are included when estimating the *total* known cause fatalities (see Table 18).

5.3.1 Total Fatality Estimates for Known Causes

There were 131 bird detections where the cause of death or injury could be determined and were facility related, of which 111 were included in the fatality estimate model (Tables 17a and 17b); of these 111 detections, 23 were from the ACC. Detections within the ACC were added unadjusted to the estimator

output to produce the total fatality estimate of known cause (Table 18, 19). There were 20 detections showing evidence of singeing, collision, or electrocution that were not included in the fatality estimates. Six detections were excluded because they were outside the standardized survey areas and 14 were excluded because they were determined to be older than the search interval.

Table 17a. Number of Bird Detections Based on Known Causes in Each Project Element Included or Excluded from Fatality Estimates, by Cause.

	Included			Excluded			
Location	Collision	Flux	Other (Electrocution)	Collision	Flux	Other (Electrocution)	Total
Tower Area	5	89	0	0	11	0	105
Heliostat Area	14	1	0	6	0	0	21
Fenceline	1	0	0	1	0	0	1
Collector Line	1	0	0	0	0	0	1
Other Project Lands	0	0	0	1	0	1	2
Total	21	90	0	8	11	1	131

Table 17b. Number of Bird Detections Based on Known Causes in Each Project Element Included or Excluded from Fatality Estimates, by Carcass Size.

	Included			Excluded			
Location	Large Birds	Small Birds	Raptors*	Large Birds	Small Birds	Raptors*	Total
Tower Area	2	92	0	0	10	1	105
Heliostat Area	5	9	1	3	3	0	21
Fenceline	1	0	0	0	1	0	1
Collector Line	0	1	0	0	0	0	1
Other Project Lands	0	0	0	1	1	0	2
Total	8	102	1	4	15	1	131

* All raptors are considered "Large Birds"

During the period 16 March – 24 May 2015 (69 days of monitoring), there were an estimated 464 fatalities (90% confidence interval 331-655) based on detections from known causes (i.e., singeing, collision, or other (Table 20). Of these, 247 fatalities (53.2%) were estimated for the 2,991-acre heliostat area and 209 fatalities (45.0%) were estimated for the 154-acre tower area; only one detection of known cause was found at the fenceline and the collector line, respectively; therefore no estimates are provided for unit fences or collector line.

Table 18. 2015 Spring Season Avian Fatality Estimates by Cause and Project Element (with 90% Confidence Interval) Based on Detections of Known Causes Included in the Model.

Location	Collision	Singed	Other (Electrocution)	Total Estimate by Location†
Tower Area	N ≤ 5*	194 (161-249)	0	209 (173-269)
Heliostat Area	240 (130-397)	N ≤ 5	0	247 (139-408)
Fenceline	N ≤ 5	0	0	N ≤ 5
Collector Line	N ≤ 5	0	0	N ≤ 5
Total Estimate by Cause†	263 (146-417)	201 (167-258)	0	464 (331-655)

* N ≤ 5 indicates that fewer than 5 detections and no fatality estimate is provided

† Rows and columns may not sum to estimated totals since estimates are not provided when 5 or fewer detections are recorded in a fatality category; however, contributions from these categories *are included* in the total estimates

Table 19. 2015 Spring Season Avian Fatality Estimates by Carcass Size and Project Element (with 90% Confidence Interval) Based on Detections of Known Causes Included in the Model.

Location	Large Birds	Small Birds	Raptors	Total Estimate by Location†
Tower Area	N ≤ 5*	206 (170-266)	0	209 (173-269)
Heliostat Area	N ≤ 5	197 (95-354)	N ≤ 5	247 (139-408)
Fenceline	N ≤ 5	0	0	N ≤ 5
Collector Line	0	N ≤ 5	0	N ≤ 5
Total Estimate by Size†	56 (25-96)	408 (281-592)	N ≤ 5	464 (331-655)

* N ≤ 5 indicates that fewer than 5 detections and no fatality estimate is provided

† Rows and columns may not sum to estimated totals since estimates are not provided when 5 or fewer detections are recorded in a fatality category; however, detections from these categories *are included* in the total estimates.

5.3.2 Fatality Estimate for Tower Area

Tables 18 and 19 present the fatality estimates for known causes within the tower area, broken down by cause or carcass size, respectively. A subset of the incidental detections in the power block were included within the Tower Area total estimate, due to the assumption of a daily search interval; those incidental detections in the power block which were determined to be older than 24 hours were not included in the fatality estimator. Estimates from the tower area should be interpreted with caution due to the inclusion of numerous incidental discoveries in the power block.

5.3.4 Fatality Estimate for Fenceline

The perimeter fencelines for all units, as well as the CIA fence, were surveyed throughout the 2015 spring period. A single detection was found during fence surveys with direct evidence of collision with a heliostat, and included in the fatality estimator. A single cinnamon teal feather spot was discovered along the Unit 1 fence near a heliostat with a large, imprint on the heliostat mirror. Since fewer than five detections of known cause were made along fences an adjusted estimate is not provided.

5.3.5 Fatality Estimate for Unit 3 Collector Line (Overhead Lines)

The Unit 3 collector line was searched during the 2015 spring monitoring season. A single detection of known cause (collision) was found in this area, thus an adjusted estimate is not provided.

5.4 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 known causes (i.e., singeing, collision, entrapment, or predation) was noted in the case of these unknown detections, they cannot be clearly included in an estimate attributed to a specific cause. 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 54 detections where the cause of death could not be determined, of which 35 were included in the fatality estimator (Tables 20a and 20b). The 19 unknown detections that were excluded from the estimator included 3 detections outside of survey areas, and 16 detections determined to be older than the search interval.

Table 20a Number of Detections from Unknown Causes in Each Project Element, and Number Included in Fatality Estimates, by Cause.

Location	Included	Excluded	Total
Tower Area	9	4	13
Heliostat Area	19	12	31
Fenceline	5	0	5
Collector Line	2	0	2
Other Project Lands	0	3	3
Total	35	19	54

Table 20b. Number of Detections from Unknown Causes in Each Project Element, and Number Included in Fatality Estimates, by Carcass Size.

	Included			Excluded			
Location	Large Birds	Small Birds	Raptors*	Large Birds	Small Birds	Raptors*	Total
Tower Area	2	7	0	2	2	0	13
Heliostat Area	5	14	0	3	8	1	31
Fenceline	4	1	0	0	0	0	5
Collector Line	0	2	0	0	0	0	2
Other Project Lands	0	0	0	2	1	0	3
Total	11	24	0	7	11	1	54

* All raptors are considered large birds

5.4.1 Total Fatality Estimates from Unknown Causes

During the period of 16 March – 24 May 2015, the total estimate of fatalities from unknown cause was 477 (90% confidence interval 276-787; Table 21). A total of 26 (90% confidence interval 20-34) were attributed to the tower area, 424 (90% confidence interval estimates 238-738) in the heliostat area. Five or fewer detections were recorded at unit fences and the collector line, therefore no estimates are provided for these project components. Of the estimated unknown cause fatalities, small birds accounted for 84.5% of the estimated fatalities (Table 22).

Table 21. Site-Wide Fatality Estimates from Unknown Causes (with 90% Confidence Interval) by Location, 16 March – 24 May 2015.

Project Area	Estimate (90% CI)
Tower Area	26 (20-34)
Heliostat Area	424 (238-738)
Fenceline	N ≤ 5*
Collector Line	N ≤ 5
Total Estimate†	477 (276-787)

* N ≤ 5 indicates that fewer than 5 detections and no fatality estimate is provided

† Rows and columns may not sum to estimated totals since estimates are not provided when 5 or fewer detections are recorded in a fatality category; however, detections from these categories *are included* in the total estimates.

Table 22. Site-Wide Fatality Estimates from Unknown Causes by Size (with 90% Confidence Interval) and Project Area, 16 March – 24 May 2015.

Location	Large Birds	Small Birds	Raptors	Total Estimate by Location†
Tower Area	N ≤ 5*	22 (17-30)	0	26 (20-34)
Heliostat Area	N ≤ 5	366 (185-665)	0	424 (238-738)
Fenceline	N ≤ 5	N ≤ 5	0	N ≤ 5
Collector line	N ≤ 5	N ≤ 5	0	N ≤ 5
Total Estimate by Size†	74 (34-123)	403 (209-696)	0	477 (276-787)

* N ≤ 5 indicates that fewer than 5 detections and no fatality estimate is provided

† Rows and columns may not sum to estimated totals since estimates are not provided when 5 or fewer detections are recorded in a fatality category; however, detections from these categories *are included* in the total estimates.

5.5 Golden Eagle Data Summary

Data related to golden eagle territory occupancy and reproductive success is being tracked by other entities, and such data, to the extent obtainable, is included in this report. As of 5 August 2015, new information has not been received regarding golden eagle monitoring efforts being performed near the Project. However, Information for golden eagle activity is provided in the winter 2014 – 2015 winter report.

5.6 Regional Awareness Monitoring

As per the plan requirements, 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. During the 2015 spring season, a Project Designated Biologist contacted local wildlife rehabilitators who did not indicate an increase in avian fatalities or provide reports of receiving singed birds brought in by the public during the 2015 spring season.

Section 6.0 Discussion

The 2015 spring 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.

6.1 Temporal Patterns in Detections

The number of detections reported at the tower area increased after 2 April 2015 coinciding with an increase in small passerine migration activity. A tower area search during the 2015 spring season is a look back over approximately 7 days, so it would be expected that short search interval at the tower areas would reflect pulses in small passerine migration. BirdCast analysis reported light to moderate migration movements in California and the Desert Southwest throughout the 2015 spring season. Only one day of heavy migration activity was noted in the Desert Southwest on 14 April 2015, and seven singed detections were found during a tower area search on 16 April 2015. Conversely, eight signed detections were found at a tower area on a date that did not align with a BirdCast report of heavy migration. Although the BirdCast migration analysis is coarse compared to the location-specific fatality monitoring at the Project, the number of detections recorded during the 2015 spring season can be considered representative of generally light to moderate movements of migrants in the Desert Southwest region.

6.2 Spatial Patterns Detections and Fatality Estimates

The distribution of known cause detections varied by facility area. Of collision detections, 69% were located in the heliostat area consistent with the risk of the heliostats to birds. Of singed detections, 99% occurred in the tower area indicating that singed birds rarely transition outside of the tower area. Unknown cause detections accounted for approximately 29% of all detections during the 2015 spring season, and the distribution of the unknown cause detections varied by facility type with 76% occurring outside of the tower area, suggesting unknown cause detections were not associated with singed birds as feather spots were closely examined for signs of singeing. Of the unknown cause detections, 27.8% were feather spots and 46.3% were partial carcasses that showed signs of scavenging. Determining a cause of mortality from a feather spot or partial carcass (74.1% of unknown cause detections) is challenging because sources of mortality such as collision or predation would rarely leave visible evidence on the feathers as would flux effects. Thus, feather spots with an unknown cause of mortality could be encountered anywhere birds occur, and an unknown cause of mortality is not unique to the Project. Further, the large proportion of feather spots among the detections for the Project as a whole may inflate the fatality estimate when unknown cause detections are included based on the potential for multiple feather spots resulting from one fatality, feather spots resulting from predation not associated with the facility, or other causes.

Section 7.0 Framework for Management and Risk Response

According to Section 5.3 of the Plan, migratory bird mortality at Ivanpah is categorized 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."

Only limited conclusions can be drawn from the 2015 spring 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 by species or groups of species from this project would be categorized as low. A more complete analysis will be conducted for the annual report. Approximately 65% of the detections were small passerines, and in general small passerines are short-lived, have high reproductive output, and their population growth rates are less sensitive to changes in survival rates than to changes in reproductive rates (Stahl and Oli 2006). Therefore, mortality of most small passerine species is expected to have negligible effects on population dynamics.

None of the 12 species represented by more than three detections is particularly rare locally, regionally, or nationally. Rather, all 12 species are relatively abundant and widespread in the western U.S. Thus, the magnitude of detections of these species at the Project during the 2015 spring season does not rise above the "low" category. Special-status species recorded as detections were 3 yellow warblers (California species of special concern) and one bank swallow (California State threatened).

Yellow warblers are one of the most abundant warblers in North America and occur as both migrants and summer residents in California (Shuford and Gardali 2008). Yellow warblers occur in the Mojave Desert as common migrants, but they typically do not breed there. An estimated 600,000 yellow warblers occur within California and an estimated 34,000,000 occur in the United States (Partners in Flight Science Committee 2013). The three yellow warblers detected represented a very small proportion of these populations; thus, the estimated yellow warbler fatalities during the 2015 spring season does not rise above the "low" category, as loss of this magnitude would have a minimal effect on populations at all geographic scales (local, regional, national or global).

Bank swallows are listed as California state threatened due to a declining population throughout the state, and most bank swallows nest along the Sacramento River and its tributaries (BSTAC 2013). An estimated 20,000 bank swallows occur within California and an estimated 6,000,000 occur in North America (Partners in Flight Science Committee 2013). As the Project area does not contain bank

swallow nesting habitat, the detection likely is of a migrating individual that could breed as far north as Alaska. Thus, the fatality of one bank swallow represents a very small proportion of these populations; thus, the estimated bank swallow fatalities during the 2015 spring season does not rise above the "low" category, as loss of this magnitude would have a minimal effect on populations at all geographic scales (local, regional, national or global).

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Appendix A. Individual Avian Detections.

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_160_ISEGS	Horned Lark	HOLA	Carcass Survey	4/27/2015	4/27/2015	Broken up	8-24 hours	Partial carcass. Head and left wing missing. 19 flight feathers (5 tail, 14 wing) and 50+ body feathers. Body found stuck on creosote branch, partly scavenged at breast and wing suggesting depredation. No singe.	Unknown	NA	3	637770, 3937907	heliostat	NA
2015_161_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/27/2015	4/27/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. Tail and breast feathers with flux grade 1 & 3 singe.	Scorched or singed	1,3	3	637471, 3937962	ACC Building	NA
2015_162_ISEGS	Rock Pigeon	ROPI	Carcass Survey	4/27/2015	4/27/2015	Broken up	3-6 days	Partial carcass and feather spot (primary, secondary, and tail flight feathers) with both legs, feet, and partial breast. Singe visible on primaries.	Scorched or singed	1,3	3	637415, 3938114	heliostat	NA
2015_163_ISEGS	Rufous Hummingbird	RUHU	Carcass Survey	4/27/2015	4/27/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singe on top of head, nape, rump, and left flank. Retrices singed and curled. Slight singe on tip of primaries on left wing.	Scorched or singed	3,3	3	637512, 3937965	ACC Building	NA
2015_164_ISEGS	Mourning Dove	MODO	Incidental	4/28/2015	4/28/2015	Broken up	0-8 hours	Broken up; feather spot with head. ~12 primaries and rectrices and 200+ body feathers. Carcass fresh with eyes moist and feathers unweathered. No evidence of singeing.	Unknown	NA	2	639022, 3937063	Fencing	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_047_ISEGS	Green-winged Teal	GWTE	Carcass Survey	3/16/2015	3/16/2015	Broken up	7 days	Primarily feather spot, accompanied by part of leg. >500 body feathers. Detached leg with small amount of dried skin and feathers. Heliostat imprint observed. No singe. Feather spot= large	Collision with solar panel/heliostat	NA	3	636975, 3936896	Heliostat	Updated 'Condition': Broken Up. Remainder of carcass was found on 03/24/2015 during fatalty surveys in two different spots ~ 65m from initial fatality discovery location of 2015_047_ISEGS. Determined to be the same individual based on feather type, male plumage, feather wear, and corresponding anatomical parts, specifically matching set of legs (left and right) with no duplicate parts of bird found. Updated 03/25/2015 CJM
2015_048_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	3/16/2015	3/16/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole Carcass. Damaged keratin on upper mandible. Eyes sunken and desiccated. Maggots found in carcass. No evidence of singeing	Collision with solar panel/heliostat	NA	3	636848, 3937212	Heliostat	NA
2015_049_ISEGS	Rufous Hummingbird	RUHU	Incidental	3/16/2015	3/16/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Singeing on head, rump, and 2 Tail feathers. Flux grade effect 1,3. Eyes present and moist, body pliable with no rigor mortis.	Scorched or singed	1	3	637510, 3937910	Auxilary Boiler	NA
2015_050_ISEGS	Unknown passerine	UNPA	Carcass Survey	3/17/2015	3/17/2015	Broken up	3 weeks	6 retrices, 10+ undertail coverts, all held together by small connecting portion of flesh/carcass. No singe.	Unknown	NA	3	637255, 3938495	heliostat	NA
2015_051_ISEGS	Black-Throated Sparrow	BTSP	Incidental	3/18/2015	3/18/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass, no apparent trauma. No singe.	Unknown	NA	NA	638029, 3935030	Transmission Tower	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_052_ISEGS	Greater Roadrunner	GRRO	Incidental	3/19/2015	3/18/2015	Mummified	1 month +	Whole carcass. Bird was discovered inside heliostat worm drive area. Body is contorted and pressed into the shape of the surrounding worm drive, with broken leg, evidencing collision with/crushing by mechanical operation of heliostat assembly. No imprint	Collision with solar panel/heliostat	NA	2	639257, 3936623	heliostat	NA
2015_053_ISEGS	Eared Grebe	EAGR	Incidental	3/21/2015	3/21/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Broken bill, bleeding, and proximity to project buildings as evidence of impact. Eyes moist and no sign of rigor mortis. No singe.	Collision (other)	NA	1	640396, 3933500	Solar Concentrating Tower	NA
2015_054_ISEGS	Northern Rough-winged Swallow	NRWS	Carcass Survey	3/23/2015	3/23/2015	Broken up	1 month +	Right wing found. Feathers very weathered. No evidence of singeing.	Unknown	NA	3	637453, 3937919	Steam Pipe	NA
2015_055_ISEGS	Violet-green Swallow	VGSW	Carcass Survey	3/24/2015	3/24/2015	Broken up	7 days	Whole wing, leg, and clumps of breast feathers found. Evidence of singeing on flight and body feathers.	Scorched or singed	1	2	638498, 3935707	Heliostat	NA
2015_056_ISEGS	Black-tailed Gnatcatcher	BTGN	Carcass Survey	3/24/2015	3/24/2015	Broken up	7 days	Partially intact right wing (no bone), partial tail attached to piece of flesh, 50+ body feathers. No evidence of singeing.	Unknown	NA	3	636681, 3939066	Heliostat	NA
2015_057_ISEGS	American Wigeon	AMWI	Carcass Survey	3/25/2015	3/25/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Whole carcass, no evidence of singeing, no evidence of collision.	Unknown	NA	2	639199, 3935507	Heliostat	NA
2015_058_ISEGS	Mourning Dove	MODO	Carcass Survey	3/25/2015	3/25/2015	Broken up	1 month +	9 coverts, 30+ body feathers with pieces of flesh holding feathers together.	Unknown	NA	1	640544, 3933385	heliostat	NA
2015_059_ISEGS	Greater Roadrunner	GRRO	Carcass Survey	3/25/2015	3/25/2015	Feather spot	2 weeks	15 flight feathers, > 500 body feathers.	Unknown	NA	1	640736, 3934579	Fencing	NA
2015_060_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	3/26/2015	3/26/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass, eyes sunken. Tail and upper tail coverts broke from carcass during processing, but were intact at time of discovery. No singe.	Unknown	NA	1	640794, 3934521	heliostat	NA
2015_061_ISEGS	Brewer's Sparrow	BRSP	Carcass Survey	3/27/2015	3/27/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass, eyes sunken. Tail and upper tail coverts broke from carcass during processing, but were intact at time of discovery. No singe.	Unknown	NA	1	640073, 3933996	heliostat	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_062_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	3/27/2015	3/27/2015	Broken up	3-6 days	Partial carcass, torso, wings, and tail feathers recovered. No singe.	Unknown	NA	1	640547, 3933960	heliostat	NA
2015_063_ISEGS	Northern Rough-winged Swallow	NRWS	Incidental	3/27/2015	3/27/2015	Alive, injured	0-8 hours	Over 50% of wing and tail feathers showing clear signs of singeing and curling.	Scorched or singed	3,3	3	637417, 3937963	Power Block	NA
2015_064_ISEGS	Ruby-crowned Kinglet	RCKI	Incidental	3/28/2015	3/28/2015	Dead, fresh (eyes moist)	0-8 hours	Grade 3 flux curling and charring. Majority of feathers with singe. No sign of impact trauma.	Scorched or singed	3	2	638598, 3935870	Power Block	NA
2015_065_ISEGS	Lesser Goldfinch	LEGO	Incidental	3/29/2015	3/29/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass at discovery. Scavenged pre-collection. Charring and curling on contour and flight feathers. No other collision trauma.	Scorched or singed	3	2	638669, 3935849	Power Block	NA
2015_066_ISEGS	Mourning Dove	MODO	Carcass Survey	3/30/2015	3/30/2015	Broken up	1 month +	20+ body feathers/tail feathers with evidence of chewing. Skin attached.	Unknown	NA	3	638926, 3937724	Heliostat	NA
2015_067_ISEGS	Green-winged Teal	GWTE	Carcass Survey	3/30/2015	3/30/2015	Feather spot	2 weeks	Body feathers and down feathers ~125 found.	Unknown	NA	3	638364, 3938987	heliostat	NA
2015_068_ISEGS	Northern Rough-winged Swallow	NRWS	Carcass Survey	3/30/2015	3/30/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found on power block. Majority of flight feathers curled and singed. Body contour feathers also show singe. Some feathers scattered in immediate area. Flux grade 3. No sign of collision trauma.	Scorched or singed	3	3	637511, 3938014	Power Block	NA
2015_069_ISEGS	Tree Swallow	TRES	Carcass Survey	3/30/2015	3/30/2015	Dead, fresh (eyes moist)	0-8 hours	Curling and singeing on over 90% of dorsal side. Carcass intact.	Scorched or singed	1	3	637491, 3937946	ACC Building	NA
2015_070_ISEGS	Verdin	VERD	Carcass Survey	3/30/2015	3/30/2015	Dead, fresh (eyes moist)	8-24 hours	Singe at outer tips of primaries on both wings, difficult to discern naked eye but visible through dissecting scope. Grade 1 flux effect.	Scorched or singed	1	3	637463, 3937953	ACC Building	NA
2015_071_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	3/31/2015	3/31/2015	Dead, fresh (eyes moist)	8-24 hours	Flux grade 3, flight and body feathers curled and singed. Whole carcass found.	Scorched or singed	3	2	638641, 3935893	ACC Building	NA
2015_072_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	3/31/2015	3/31/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Majority of flight and body feathers show singe and curling, flux grade 3.	Scorched or singed	3	2	638654, 3935891	ACC Building	NA
2015_073_ISEGS	Cooper's Hawk	COHA	Incidental	3/31/2015	3/31/2015	Mummified	1 month +	Carcass with small amount (approximately 20) small contour feathers detached and in immediate area. Carcass mummified and completely dessicated. Signs of past scavenging are present. Age and condition of carcass make cause of death diagnosis difficult to	Unknown	NA	1	639677, 3933773	heliostat	NA

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2015_074_ISEGS	Eared Grebe	EAGR	Incidental	3/31/2015	3/31/2015	Broken up	1 month +	Head, spine pieces, downy body feathers (approx 130) found incidentally by workers. Dessicated skull with few feathers. No singe or visible impact trauma.	Unknown	NA	NA	639868, 3934843	Project Building	NA
2015_075_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	3/31/2015	3/31/2015	Feather spot	3-6 days	9 tail feathers, 39 body feathers. FS = Large. No sign of singe or collision trauma.	Unknown	NA	3	636358, 3937483	heliostat	NA
2015_076_ISEGS	Cinnamon Teal	CITE	Carcass Survey	4/1/2015	4/1/2015	Feather spot	3-6 days	Large feather spot. Heliostat imprint of matching size found. ~400 body feathers found in addition to small flight feathers. No evidence of singeing.	Collision with solar panel/heliostat	NA	1	640817, 3934584	Fencing	NA
2015_077_ISEGS	Greater Roadrunner	GRRO	Carcass Survey	4/2/2015	4/2/2015	Feather spot	3-6 days	Large feather spot. 3 retricies, 3 trailing secondaries, and 50+ body feathers. No singe	Unknown	NA	1	639509, 3934075	Heliostat	NA
2015_078_ISEGS	Cliff Swallow	CLSW	Carcass Survey	4/6/2015	4/6/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass found. Flux grade 2 & 3, flight and body feathers curled and singed.	Scorched or singed	3	3	637487, 3937970	ACC Building	NA
2015_079_ISEGS	Unknown Swallow	UNSW	Carcass Survey	4/6/2015	4/6/2015	Broken up	7 days	Broken up partial carcass-body feathers attached to dried skin and right leg. No singe.	Unknown	NA	3	637520, 3937926	Auxilary Boiler	NA
2015_080_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/6/2015	4/6/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Flux grade 2 & 3, flight and body feathers curled and singed.	Scorched or singed	3,3	3	637432, 3937950	Project Building	NA
2015_081_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/6/2015	4/6/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Flux grade 2 & 3, flight and body feathers curled and singed.	Scorched or singed	3,3	3	637433, 3937967	Steam Pipe	NA
2015_082_ISEGS	Northern Rough-winged Swallow	NRWS	Carcass Survey	4/6/2015	4/6/2015	Broken up	3-6 days	Broken up partial wing with exposed bone. Evidence of singeing on primaries and secondaries on wing.	Scorched or singed	2	3	637399, 3938000	Ground	NA
2015_083_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/6/2015	4/6/2015	Dead, fresh (eyes moist)	8-24 hours	Carcass with curled feathers, no evidence of collision. Singed.	Scorched or singed	3,3	3	637589, 3937951	heliostat	NA
2015_084_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/6/2015	4/6/2015	Dead, fresh (eyes moist)	8-24 hours	Carcass with Grade 2&3 flux evident. Flight and contour feathers curled. No evidence of collision.	Scorched or singed	3,3	3	637584, 3937938	heliostat	NA
2015_085_ISEGS	Unknown passerine	UNPA	Carcass Survey	4/7/2015	4/7/2015	Mummified	1 month +	Evidence of curling on all major flight feathers. Additional singe on head, back, breast, flanks. Singed.	Scorched or singed	3,3	2	638688, 3935883	ACC Building	NA

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2015_086_ISEGS	Violet-green Swallow	VGSW	Carcass Survey	4/7/2015	4/7/2015	Dead, fresh (eyes moist)	8-24 hours	Evidence of singeing on back, breast, side, and top of head. Flight feathers singed and curled, retrices singed and missing.	Scorched or singed	3,3	2	638672, 3935894	ACC Building	NA
2015_087_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	4/7/2015	4/7/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Singe on head, back, flank, and flight feathers, specifically in retrices.	Scorched or singed	1,3	2	638583, 3935891	Water Tank Pipe	NA
2015_088_ISEGS	American Kestrel	AMKE	Carcass Survey	4/7/2015	4/7/2015	Feather spot	2 weeks	Feather spot = Large. 3 Retrices, 19 body feathers. Tail curled from singe, body feathers singed (Flux grade 3).	Scorched or singed	3	2	638583, 3935889	Water Tank Pipe	NA
2015_089_ISEGS	Lesser Nighthawk	LENI	Carcass Survey	4/8/2015	4/8/2015	Broken up	3-6 days	Sternum with exposed bone and dried muscle, partial wing, dried stomach, and feathers found (3 secondaries, approx 150 body feathers). No singe or collision evidence found.	Unknown	NA	1	640161, 3933428	heliostat	NA
2015_090_ISEGS	Rufous Hummingbird	RUHU	Carcass Survey	4/8/2015	4/8/2015	Broken up	8-24 hours	Carcass with partial tail. Bill shows convex warping, possibly from collision, post-singe. Entire dorsal side and head singed. Tips of flight feathers singed. Flux grade 1 & 3.	Scorched or singed	3	1	640360, 3933534	ACC Building	NA
2015_091_ISEGS	Horned Lark	HOLA	Incidental	4/9/2015	4/9/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass intact. Fledgling bird, no trauma or sign of scavenging. No singe.	Unknown	NA	2	638113, 3936980	heliostat	Updated 'How Found': found incidentally outside outer heliostat 5-acre plot after completing standard survey. 07/15/2015 CJM
2015_092_ISEGS	Horned Lark	HOLA	Incidental	4/9/2015	4/9/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass intact. Fledgling bird, no trauma or sign of scavenging. No singe.	Unknown	NA	2	638113, 3936980	Heliostat	Updated 'How Found': found incidentally outside outer heliostat 5-acre plot after completing standard survey. 07/15/2015 CJM
2015_093_ISEGS	American Robin	AMRO	Incidental	4/9/2015	4/9/2015	Broken up	2 weeks	Partial carcass (wing). All primaries and secondaries intact on right wing. No evidence of collision. No singe.	Unknown	NA	1	639785, 3932990	heliostat	NA

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2015_094_ISEGS	Cactus Wren	CACW	Carcass Survey	4/9/2015	4/9/2015	Broken up	1 month +	Portions of skull and skeleton found with feather spot (~55 feathers) at collapsed nest. Nest inside worm drive of heliostat. Skull shows signs of impact, as does nest, suggesting crushing by heliostat assembly. ROPI feathers found at nest appear to have	Collision with solar panel/heliostat	NA	2	639642, 3935412	Heliostat	NA
2015_095_ISEGS	Northern Rough-winged Swallow	NRWS	Incidental	4/12/2015	4/12/2015	Alive, injured	0-8 hours	Singed feathers on both wings, tail, dorsal contour feathers, and right side of face. Flux grades 2 & 3. Bird unable to fly.	Scorched or singed	3,3	3	637408, 3937879	Solar Concentrating Tower	NA
2015_096_ISEGS	Bank Swallow	BANS	Incidental	4/12/2015	4/12/2015	Alive, injured	0-8 hours	Singed on both wings, tail, and dorsal contour feathers. Singe grade 2 & 3. Bird alive when found.	Scorched or singed	3,3	3	637408, 3937879	Project Building	NA
2015_097_ISEGS	American Kestrel	AMKE	Carcass Survey	4/13/2015	4/13/2015	Alive, injured	0-8 hours	Singed primaries, secondary coverts, tail feathers, body and head feathers, flux grade 2 & 3. Unable to fly. At time of capture the bird had sufficient fat (breast) and water stores.	Scorched or singed	3,3	3	637404, 3938505	heliostat	NA
2015_098_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/13/2015	4/13/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Intact carcass, singeing on contour feathers, tail feathers, rump, chest, and flanks. Flux grades 1 & 3.	Scorched or singed	1,3	3	637465, 3937982	ACC Building	NA
2015_099_ISEGS	Unknown hummingbird	UNHU	Carcass Survey	4/13/2015	4/13/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Flight, body, and tail feathers singed.	Scorched or singed	3	3	637523, 3937937	ACC Building	NA
2015_100_ISEGS	Blue-Gray Gnatcatcher	BGGN	Carcass Survey	4/13/2015	4/13/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Found near heliostat with imprint matching size and species structure. No singe.	Collision with solar panel/heliostat	NA	3	637303, 3938070	heliostat	NA
2015_101_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/13/2015	4/13/2015	Dead, fresh (eyes moist)	8-24 hours	Intact carcass. Imprint matching size and species on nearest heliostat, evidencing collision. No singe.	Collision with solar panel/heliostat	NA	3	637417, 3938106	Heliostat	NA
2015_102_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/13/2015	4/13/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Tail feathers and tips of primaries singed and curled.	Scorched or singed	3,3	3	637488, 3937857	Solar Concentrating Tower	NA

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2015_103_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/14/2015	4/14/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Evidence of singeing on majority of flight feathers and dorsal side of body feathers. Carcass fresh with unweathered feathers and no rigor mortis.	Scorched or singed	3,3	2	638654, 3935865	ACC Building	NA
2015_165_ISEGS	Wilson's Warbler	WIWA	Carcass Survey	4/28/2015	4/28/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Evidence of singeing on flight feathers and rump, back, and nape of body. Flux grade 2 & 3. Slight rigor mortis and eyes dehydrated.	Scorched or singed	3,3	2	638678, 3935902	ACC Building	NA
2015_166_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/28/2015	4/28/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Carcass fresh due to moist eyes and pliable body. Evidence of curling on flight feathers and retrices, singeing on >75% of entire body. Flux grade effect 2 & 3.	Scorched or singed	3,3	2	638629, 3935778	Ground	NA
2015_167_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/28/2015	4/28/2015	Alive, injured	0-8 hours	Evidence of singeing on secondaries and edge of primaries on left wing.	Scorched or singed	1	2	638558, 3935624	Heliostat	NA
2015_168_ISEGS	Barn Swallow	BARS	Incidental	4/28/2015	4/28/2015	Alive, injured	0-8 hours	Evidence of curling on primaries, secondaries of both wings and retrices. Bird died eventually. Flux grade effect 2 & 3.	Scorched or singed	3,3	2	638584, 3935817	Project Building	NA
2015_169_ISEGS	Calliope Hummingbird	CAHU	Incidental	4/28/2015	4/28/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Evidence of singeing on flight feathers and rump, back, and nape of body. Flux grade 2 & 3.	Scorched or singed	3,3	1	640343, 3933464	Vehicle	Updated Species: Calliope Hummingbird; Species based on buffy flanks and white belly, partial streaked rosy gorget, rufous in tail, wing chord and bill length. Updated 04/29/2015 CJM
2015_170_ISEGS	Lazuli Bunting	LAZB	Carcass Survey	4/28/2015	4/28/2015	Alive, injured	0-8 hours	Injured bird found alive, captured, and translocated back to office. No evidence of singeing. Heliostat imprint found.	Collision with solar panel/heliostat	NA	2	639218, 3935769	Heliostat	NA
2015_171_ISEGS	Unknown Passerine	UNPA	Carcass Survey	4/29/2015	4/29/2015	Broken up	3-6 days	Broken up, feather spot connected by dried flesh. 20+ body feathers. No evidence of singeing.	Unknown	NA	1	640306, 3933694	Heliostat	NA
2015_172_ISEGS	Rufous Hummingbird	RUHU	Incidental	4/29/2015	4/29/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass found. Evidence of curling in flight feathers and retrices and singeing in head, rump, and nape. Flux grade effect 2 & 3. Carcass pliable, fresh, and feathers unweathered.	Scorched or singed	3,3	2	638706, 3935932	Ground	NA

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2015_173_ISEGS	Unknown Passerine	UNPA	Carcass Survey	4/29/2015	4/29/2015	Feather spot	3-6 days	Feather spot consisting of 13 body feathers. No evidence of collision or singeing. Feathers fluffy but weathered.	Unknown	NA	1	640754, 3933780	Heliostat	NA
2015_174_ISEGS	Orange-crowned Warbler	OCWA	Incidental	4/29/2015	4/29/2015	Mummified	3 weeks	Whole carcass found. Mummified based on desiccation of body, internal organs dried. Evidence of singeing on crown, upper dorsal, and tips of primaries..	Scorched or singed	1,3	1	640378, 3933488	Solar Concentrating Tower	NA
2015_204_ISEGS	Townsend's Warbler	TOWA	Carcass Survey	5/7/2015	5/7/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. No obvious sign of trauma. Fresh, close to heliostat.	Collision with solar panel/heliostat	NA	1	639662, 3933019	Heliostat	NA
2015_205_ISEGS	Western Tanager	WETA	Incidental	5/8/2015	5/8/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found on Colosseum Road by designated biologist. Evidence of collision with car based on location of carcass and condition of exposed organs. No singe.	Collision (other)	NA	NA	639129, 3935056	Fencing	Updated 'Suspected Cause': Collision (other) 05/13/2015 BGZ
2015_206_ISEGS	Townsend's Warbler	TOWA	Incidental	5/8/2015	5/8/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found as incidental. Evidence of collision by structurally damaged and partially detached lower mandiable. No evidence of singe.	Unknown	NA	NA	637695, 3936209	Fencing	NA
2015_207_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	5/8/2015	5/8/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Evidence of collision by broken neck. No evidence of singe.	Collision with solar panel/heliostat	NA	2	637717, 3936233	Heliostat	NA
2015_208_ISEGS	Western Tanager	WETA	Carcass Survey	5/8/2015	5/8/2015	Alive, injured	0-8 hours	Injured bird found alive along Unit #2 perimeter fence. It was captured, and translocated back to office. No evidence of singeing.	Unknown	NA	2	637704, 3935470	Fencing	NA
2015_209_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	5/11/2015	5/11/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Evidence of curling on primaries, secondaries, and retrices of flight feathers, singeing on right side of face, nape, back, and left flank. Flux grade effect 2 & 3.	Scorched or singed	3,3	2	638620, 3935899	ACC Building	NA
2015_210_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/11/2015	5/11/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Evidence of curling on primaries, secondaries, and retrices of flight feathers, singeing on head, nape, back, and rump. Flux grade effect 2 & 3.	Scorched or singed	3,3	2	638647, 3935883	Powerblock	NA

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2015_211_ISEGS	Snowy Egret	SNEG	Incidental	5/12/2015	5/12/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found. Evidence of collision on heliostat mirror matching size and shape of species, structural damage to tip of bill. No singe effect.	Collision with solar panel/heliostat	NA	1	641334, 3933059	heliostat	NA
2015_212_ISEGS	Black-Headed Grosbeak	BHGR	Carcass Survey	5/13/2015	5/13/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Evidence of collision by structural damage to upper mandible. No evidence of singe.	Collision (other)	NA	2	637950, 3935030	Overhead Lines	Updated 'Suspected Cause': Collision (other) 05/18/2015 CJM
2015_213_ISEGS	Mourning Dove	MODO	Carcass	5/13/2015	5/13/2015	Feather spot	3-6 days	Feather spot consisting of 9 flight feathers and 20 body feathers. No evidence of collision or singe.	Unknown	NA	2	638243, 3936329	heliostat	NA
2015_104_ISEGS	Unknown Hummingbird	UNHU	Carcass Survey	4/14/2015	4/14/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Evidence of singeing on majority of body and all flight feathers.	Scorched or singed	3,3	2	638648, 3935873	ACC Building	NA
2015_105_ISEGS	Ruby-crowned Kinglet	RCKI	Carcass Survey	4/14/2015	4/14/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Fatality fresh due to no rigor mortis and body condition with no unweathered feathers. Evidence of singeing on body, head, and flight feathers.	Scorched or singed	3,3	2	638579, 3935886	Project Building	NA
2015_106_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/14/2015	4/14/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Tail and body feathers singed and curled, flux grade 1 & 3.	Scorched or singed	1,3	2	638592, 3935927	Other Machinery	NA
2015_107_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/14/2015	4/14/2015	Broken up	3-6 days	Broken up. Carcass missing head. Evidence of collision on heliostat mirror matching size and shape of species. No singe.	Collision with solar panel/heliostat	NA	3	636988, 3937611	Heliostat	NA
2015_108_ISEGS	Lesser Nighthawk	LENI	Carcass Survey	4/15/2015	4/15/2015	Feather spot	3-6 days	Feather Spot = Small. 1 primary (P4), and 25 body feathers. Heliostat imprint matches species size/shape. No singe.	Collision with solar panel/heliostat	NA	1	640177, 3933614	heliostat	NA
2015_109_ISEGS	Unknown Passerine	UNPA	Carcass Survey	4/15/2015	4/15/2015	Feather spot	3-6 days	Feather spot = small. 30 body feathers found. No singe.	Unknown	NA	1	639467, 3934046	heliostat	NA
2015_110_ISEGS	Unknown hummingbird	UNHU	Incidental	4/15/2015	4/15/2015	dead, fresh (eyes moist)	8-24 hours	Carcass with grade 2 & 3 flux/singe on dorsal (back, head, rump) tail, and majority of wing flight feathers. Majority of tail absent. Broken bill suggests post-singe collision.	Scorched or singed	3,3	3	637522, 3937901	Project Building	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_111_ISEGS	House Wren	HOWR	Carcass Survey	4/15/2015	4/15/2015	Feather spot	3-6 days	Feather spot = small. 4 retrices, 3 primaries, 2 secondaries, 4 broken flight feathers, 15 body feathers. No singe.	Unknown	NA	1	640152, 3933449	heliostat	NA
2015_112_ISEGS	Unknown passerine	UNKN	Incidental	4/15/2015	4/15/2015	Feather spot	3-6 days	Feather spot = small. 10 contour feathers with trace amount of singe at terminal ends, discernable only through dissecting scope.	Scorched or singed	NA	2	638640, 3935871	Other Machinery	NA
2015_113_ISEGS	Brewer's Sparrow	BRSP	Carcass Survey	4/16/2015	4/16/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Bill fractured, apparent break in bird's neck. No singe.	Collision with solar panel/heliostat	NA	2	637742, 3936607	heliostat	NA
2015_114_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	4/16/2015	4/16/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Fractured lower mandible and blood found on bill. No singe.	Collision with solar panel/heliostat	NA	2	638677, 3937171	heliostat	NA
2015_115_ISEGS	Northern Rough-winged Swallow	NRWS	Incidental	4/17/2015	4/17/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Tail and flight feathers curled, body and head feather singed.	Scorched or singed	3	3	637539, 3937866	Power Block	NA
2015_116_ISEGS	Unknown passerine	UNPA	Carcass Survey	4/20/2015	4/20/2015	Feather spot	3-6 days	Secondaries, body feathers, tail and primaries found, ~110 feathers total.	Unknown	NA	3	637384, 3937959	Power Block	NA
2015_117_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Bird visibly singed: 80% flight feathers singed and curled. Head singed.	Scorched or singed	3,3	3	637370, 3937935	Power Block	NA
2015_118_ISEGS	Wilson's Warbler	WIWA	Carcass Survey	4/20/2015	4/20/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	0-8 hours	Whole carcass found. 30% of primary feathers curled, singeing on coverts, flanks, rump fully singed, tail feathers singed.	Scorched or singed	3,3	3	637415, 3937948	Power Block	NA
2015_119_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Singeing on crown, primaries, retrices , rump, and back. Curling on all flight and tail feathers.	Scorched or singed	3,3	3	637397, 3937949	Power Block	NA
2015_120_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Alive, injured	0-8 hours	Found alive, injured with Grade 2&3 flux. Transported to office, whereupon it was found dead at 1340 (see notes). Head, underside, rump, tail and wings singed. All of tail and primaries curled.	Scorched or singed	3,3	2	638622, 3935873	Power Block	NA
2015_121_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. 70% of flight feathers curled with singeing. Head and flanks singed.	Scorched or singed	3,3	2	638622, 3935873	Power Block	NA

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2015_122_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. All flight feathers and body feather singed and curled. Chest, head, and flanks are singed. Grade 2 and 3 flux.	Scorched or singed	3,3	2	638620, 3935879	Power Block	NA
2015_123_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. 80% flight feathers curled, 80% of body feathers singed. Only back found unsinged.	Scorched or singed	3,3	2	638619, 3935881	Power Block	NA
2015_124_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Retrices singed, 50% of flight feathers singed, singeing on left wing. Chest and head singed.	Scorched or singed	3	2	638619, 3935895	Power Block	NA
2015_125_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. All retrices curled. Singeing on all back and head feathers. All primaries curled, as well as secondaries and most coverts. Throat and belly feathers singed.	Scorched or singed	3,3	2	638618, 3935905	Power Block	NA
2015_126_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Singe on head, back, wing coverts, and rump. >50% flight feathers curled. Few viable primaries remain.	Scorched or singed	3,3	2	638647, 3935922	Power Block	NA
2015_127_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. All flight feathers and body feather singed and curled. Head, back and rump singed. Grade 2 and 3 flux.	Scorched or singed	3,3	2	638625, 3935855	Power Block	NA
2015_128_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Singe extensive over whole body. Flight feathers curled with no viable barbs left. Few viable feathers remain on back only.	Scorched or singed	3,3	2	638642, 0	Power Block	NA
2015_129_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. 100% flight feathers curled. Breast and head singed. Tail missing due to singe.	Scorched or singed	3,3	2	638651, 3935860	Power Block	NA
2015_130_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Underparts, head and back singed. All but outermost primaries (3 on left, 4 on right) curled. All but 2 tail feathers curled.	Scorched or singed	3,3	2	638634, 3935834	Power Block	NA
2015_131_ISEGS	Rufous Hummingbird	RUHU	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Head, back, left flank, tail singed - flux grade 2&3. Flight feathers singed, evident under dissecting scope.	Scorched or singed	3,3	3	637453, 3937950	Power Block	NA

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2015_132_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. No evidence of collision or flux.	Unknown	NA	2	638645, 3935820	Power Block	NA
2015_133_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Carcass. Entire body and all of flight feathers singed and curled. Tail is missing. Head, flanks, dorsal and ventral body singed, flux grade 2&3.	Scorched or singed	3,3	3	637443, 3937948	Power Block	NA
2015_134_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Tail feathers curled. Over 50% flight feathers on each wing singed. Back and nape singed.	Scorched or singed	3,3	3	637437, 3937953	Power Block	NA
2015_135_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Light singe on wing coverts, retrices and head. Whole carcass found.	Scorched or singed	3	2	638562, 3935923	Power Block	NA
2015_136_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	4/20/2015	4/20/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Head and back lightly singed. Retrices curled. Singeing present on belly and flanks.	Scorched or singed	3,3	3	637476, 3937933	Power Block	NA
2015_137_ISEGS	Chipping Sparrow	CHSP	Carcass Survey	4/21/2015	4/21/2015	Dead; fresh (eyes moist)	8-24 hours	Whole carcass found. Evidence of curling/singeing in all major flight feathers and nape and face; flux grade effect 2 & 3.	Scorched or singed	3,3	2	638678, 3935805	Power Block	NA
2015_138_ISEGS	Chipping Sparrow	CHSP	Carcass Survey	4/21/2015	4/21/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Evidence of curling/singeing in all major flight feathers and face and top of head; flux grade effect 2 & 3.	Scorched or singed	3,3	2	638665, 3935805	Power Block	NA
2015_139_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	4/21/2015	4/21/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Evidence of singeing on top of head and left nape, curling on retrices, flux grade effect 1 & 3.	Scorched or singed	1,3	2	638678, 3935837	Power Block	NA
2015_140_ISEGS	Mourning Dove	MODO	Carcass Survey	4/21/2015	4/21/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. No trauma, no singe. Proximity to heliostat and fresh carcass.	Collision with solar panel/heliostat	NA	3	636577, 3936902	heliostat	NA
2015_141_ISEGS	Orange-crowned Warbler	OCWA	Carcass Survey	4/21/2015	4/21/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Flux grade 2&3 on primaries, secondaries, tail, and coverts - all singed and curled. Singe present on dorsal section of head, right side of face, flank and axillary.	Scorched or singed	3,3	2	638606, 3935899	Powerblock	NA
2015_142_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	4/21/2015	4/21/2015	Mummified	3 weeks	Whole carcass found. Evidence of singeing on head and rump and in secondary flight feathers, flux grade effect 3. Body was dessicated and dry and feathers slightly weathered.	Scorched or singed	3	2	638595, 3935852	Powerblock	NA

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2015_143_ISEGS	Western Meadowlark	WEME	Carcass Survey	4/21/2015	4/21/2015	Feather spot	7 days	Feather spot = small. 6+ primaries, 20+ flight feathers total, 150+ contour feathers. No singe.	Unknown	NA	3	637566, 3937224	heliostat	NA
2015_144_ISEGS	Mourning Dove	MODO	Incidental	4/21/2015	4/21/2015	Broken up	7 days	Partial carcass. Left wing, 7 tail feathers, 40+ contour feathers. No singe.	Unknown	NA	NA	639074, 3935002	Fencing	NA
2015_145_ISEGS	Western Meadowlark	WEME	Carcass Survey	4/22/2015	4/22/2015	Mummified	2 weeks	Whole carcass found. Mummified based on desiccation of body, internal organs dried. Evidence of collision based on broken upper mandiable tip. No evidence of singeing.	Collision with solar panel/heliostat	NA	2	639431, 3936733	heliostat	NA
2015_146_ISEGS	Calliope Hummingbird	CAHU	Incidental	4/22/2015	4/22/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Singed, grade 1&3 flux on dorsal side of head, left body and flanks, left retrices, and 25% of left wing. No evidence of collision.	Scorched or singed	1,3	3	637416, 3937929	Powerblock	NA
2015_147_ISEGS	Orange-crowned Warbler	OCWA	Incidental	4/22/2015	4/22/2015	Alive, injured	0-8 hours	Bird found alive. Grade 2&3 singe evident on dorsal body, crown of head, flanks, and majority of wing and tail flight feathers. No evidence of collision.	Scorched or singed	3,3	3	637500, 3937931	Auxilary Boiler	NA
2015_148_ISEGS	Savannah Sparrow	SAVS	Carcass Survey	4/22/2015	4/22/2015	Feather spot	7 days	Feather spot comprised of 24 flight feathers and 100 body feathers. No evidence of singeing or collision. Feather size spot small.	Unknown	NA	2	638729, 3937008	Heliostat	NA
2015_149_ISEGS	Unknown Passerine	UNPA	Carcass Survey	4/22/2015	4/22/2015	Broken up	3-6 days	Broken up carcass. Partial left and right wings found. No evidence of singeing or collision. Species undetermined due to limited diagnostic features.	Unknown	NA	1	640809, 3933661	Heliostat	NA
2015_150_ISEGS	Black-chinned Hummingbird	BCHU	Incidental	4/22/2015	4/22/2015	Dead, fresh (eyes moist)	0-8 hours	Singe grade 2&3 on 80% of dorsal side, 30% of ventral side (chest), wing and tail feathers 60% singed. Gorget singed but intact. No evidence of collision.	Scorched or singed	3,3	3	637472, 3937942	Powerblock	NA
2015_151_ISEGS	Lesser Nighthawk	LENI	Carcass Survey	4/23/2015	4/23/2015	Broken up	7 days	Large feather spot with portion of bone and flesh. 8 primaries (right wing), 6+ secondaries, 7+rectrices, right wing with dry flesh and bone. No singe.	Unknown	NA	1	641084, 3933411	Heliostat	NA
2015_152_ISEGS	White-winged Dove	WWDO	Carcass Survey	4/23/2015	4/23/2015	Broken up	7 days	Feathers found: ~75 body feathers and coverts. No evidence of collision or flux.	Unknown	NA	2	639244, 3935397	Heliostat	NA
2015_153_ISEGS	Savannah Sparrow	SAVS	Carcass Survey	4/23/2015	4/23/2015	Broken up	7 days	5 primaries and right wing found. No evidence of collision or flux.	Unknown	NA	2	639242, 3935406	Heliostat	NA

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2015_154_ISEGS	Orange-crowned Warbler	OCWA	Carcass Survey	4/23/2015	4/23/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Singe grade 2/3 on dorsal side, head/crown, majority of flight feathers, and chest.	Scorched or singed	3,3	1	640395, 393350	Power Block	NA
2015_155_ISEGS	Unknown Passerine	UNPA	Carcass Survey	4/23/2015	4/23/2015	Feather spot	3-6 days	11 primaries/secondaries, ~40 body feathers collected. Singe on all flight feathers and few body feathers, flux grade 2 and 3.	Scorched or singed	3,3	1	640366, 3933506	Power Block	NA
2015_156_ISEGS	Yellow-headed Blackbird	YHBL	Carcass Survey	4/23/2015	4/23/2015	Broken up	3-6 days	Partial bird found: both wings, 2 feet, 2 flight feathers, 5 body feathers recovered. No singe effect.	Unknown	NA	1	640409, 3933481	Power Block	NA
2015_157_ISEGS	Yellow-headed Blackbird	YHBL	Incidental	4/23/2015	4/23/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Carcass. No singe. Bill is broken and lower mandible missing sections, due to breakage.	Collision with solar panel/heliostat	NA	2	637861, 3936219	Heliostat	NA
2015_158_ISEGS	Yellow-rumped Warbler	YRWA	Incidental	4/23/2015	4/23/2015	Broken up	3 weeks	Partial right wing, tail with bone & flesh, keel and ribcage, arm bone found, with 65+ body feathers. No singe.	Unknown	NA	2	637861, 3936198	Heliostat	NA
2015_159_ISEGS	Unknown Passerine	UNPA	Incidental	4/23/2015	4/23/2015	Mummified	1 month +	Partial carcass - head missing. No singe.	Unknown	NA	NA	638672, 3934979	Project Building	NA
2015_175_ISEGS	Mourning Dove	MODO	Carcass Survey	4/29/2015	4/29/2015	Mummified	2 weeks	Whole carcass found with 50 body feathers. Carcass dried and stiff with heavy rigor mortis, eyes gone indicating 2 weeks plus. Evidence of collision with observed heliostat imprint. No evidence of singeing.	Collision with solar panel/heliostat	NA	2	639497, 3936908	Heliostat	NA
2015_176_ISEGS	Mourning Dove	MODO	Carcass Survey	4/29/2015	4/29/2015	Broken up	8-24 hours	Broken up, feather spot with 2 partial wings. 10 flight feathers, 30 body feathers, 2 partial wings in addition to flesh and bone. No evidence of collision or singeing. Feathers fresh and unweathered.	Unknown	NA	1	640407, 3933480	Auxilary Boiler	NA
2015_177_ISEGS	Mourning Dove	MODO	Carcass Survey	4/30/2015	4/30/2015	Broken up	3-6 days	Broken up, feather spot with head and partial right wing. Feather spot large consisting of primaries, secondaries, retrices and ~400 body feathers. No evidence of singeing or collision.	Unknown	NA	1	641042, 3933283	Heliostat	NA

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2015_178_ISEGS	Yellow Warbler	YEWA	Incidental	4/30/2015	4/30/2015	Alive, injured	0-8 hours	Alive at time of discovery, died 1115. Singed grade 2 & 3 on majority of primaries, secondaries (both wings) and majority of tail feathers. Singed dorsally on flank, nape, back.	Scorched or singed	3,3	2	638646, 3935836	Powerblock	NA
2015_179_ISEGS	Wilson's Warbler	WIWA	Incidental	4/30/2015	4/30/2015	Dead, fresh (eyes moist)	0-8 hours	Carcass. Trauma at tip of upper mandible, blood present, upper and lower mandible not in alignment. Small area of singe on right wing (tips of secondaries), flux grade 1. Singe would have logically occurred prior to collision.	Scorched or singed	1	2	638628, 3935826	Powerblock	NA
2015_180_ISEGS	Calliope Hummingbird	CAHU	Incidental	4/30/2015	4/30/2015	Dead, fresh (eyes moist)	0-8 hours	Carcass. Singe, flux grade 3, on top of crown and left dorsal flank. No collision evident.	Scorched or singed	3	2	638675, 3935917	Powerblock	NA
2015_181_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	5/1/2015	5/1/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. Evidence of dried blood at base of bill, small fracture on bill indicate collision trauma.	Collision with solar panel/heliostat	NA	1	640608, 3934570	heliostat	NA
2015_182_ISEGS	American Coot	AMCO	Incidental	5/4/2015	5/4/2015	Alive, injured	0-8 hours	Whole intact bird, alive and alert at discovery. No apparent trauma observed, but bird was disoriented and unable to fly. Released successfully off site. No singe.	Unknown	NA	3	638281, 3938297	heliostat	NA
2015_183_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found. Evidence of curling to primaries, secondaries and retrices, singeing to left side of face and nape. Flux grade effect 2 & 3.	Scorched or singed	3,3	3	637443, 3937969	ACC Building	NA
2015_184_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Evidence of curling on retrices, singeing on top of head, primaries, right side of face, nape, flank, and breast. Flux grade effect 1 & 3.	Scorched or singed	1,3	3	637494, 3937980	ACC Building	NA
2015_185_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	5/4/2015	5/4/2015	Broken up	2 weeks	Broken up with body, wing, and head found. Evidence of singeing on head and retrices. Flux grade effect 1 & 3.	Scorched or singed	1,3	3	637234, 3937932	Heliostat	NA
2015_186_ISEGS	Mourning Dove	MODO	Carcass Survey	5/4/2015	5/4/2015	Broken up	7 days	Broken up, with body, tail, secondaries, and leg found. Evidence of collision with heliostat imprint matching size and shape of species. No evidence of singe.	Collision with solar panel/heliostat	NA	3	637733, 3938835	Heliostat	NA

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2015_187_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Evidence of curling on primaries, secondaries, of both wings; singeing on top of head, sides of face, flanks, and retrices. Flux grade effect 2 & 3.	Scorched or singed	3,3	3	637455, 3937943	Powerblock	NA
2015_188_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Curling to entire tail, singe on primaries, nape, rump, both flanks, and axillaries. Singe grade 2 & 3.	Scorched or singed	3,3	3	637458, 3937953	Powerblock	NA
2015_189_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/4/2015	5/4/2015	Feather spot	7 days	Feather spot = small. 26 body feathers. Tips of several feathers singed, visible under scope. Singe grade 3.	Scorched or singed	3	3	637434, 3937921	Powerblock	NA
2015_190_ISEGS	Rufous Hummingbird	RUHU	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass, tail separated after pickup. Carcass moderately desiccated, with singe on outer tail feathers and top of head, nape, and rump. Flux grade 1.	Scorched or singed	1	3	637430, 3937911	Powerblock	NA
2015_191_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/4/2015	5/4/2015	Broken up	3-6 days	Wing - 5 primaries with attached flesh. Singe present on primaries, grade 2.	Scorched or singed	2	3	637406, 3937922	Powerblock	NA
2015_192_ISEGS	Mourning Dove	MODO	Carcass Survey	5/4/2015	5/4/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found with 2 body feathers (attached to mirror - imprint present). No singe.	Collision with solar panel/heliostat	NA	3	638606, 3937854	heliostat	NA
2015_193_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/5/2015	5/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Grade 1 & 3 flux, singe on rump, left flank, nape - less extensive singe on tips of primary wing feathers.	Scorched or singed	1,3	2	638654, 3935881	ACC Building	NA
2015_194_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/5/2015	5/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Flux grade 2 & 3 singe. Curling on wings (primaries, secondaries) and tail feathers. Singe on right side of face, nape, axillary, flank, and rump.	Scorched or singed	3,3	2	638621, 3935896	ACC Building	NA
2015_195_ISEGS	Yellow-rumped Warbler	YRWA	Carcass Survey	5/5/2015	5/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found. Curling on primaries, secondaries, retrices; singeing on head, nape, and back. Flux grade effect 2 & 3.	Scorched or singed	3,3	2	638648, 3935909	ACC Building	NA
2015_196_ISEGS	Black-chinned Hummingbird	BCHU	Carcass Survey	5/5/2015	5/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	7 days	Whole carcass found. Evidence of singeing on head, back, rump; retrices slightly curled on outer sides. Flux grade effect 1 & 3.	Scorched or singed	1,3	2	638730, 3935830	Powerblock	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_197_ISEGS	Mourning Dove	MODO	Carcass Survey	5/5/2015	5/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass found. Imprint on heliostat mirror matching size and shape of species supports evidence of collision. No singe.	Collision with solar panel/heliostat	NA	3	636400, 3936790	Heliostat	NA
2015_198_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/5/2015	5/5/2015	Mummified	1 month +	Skull, beak, and vertebrae found. No evidence of singeing or collision.	Unknown	NA	3	636929, 3937008	Heliostat	NA
2015_199_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	5/6/2015	5/6/2015	Broken up	3-6 days	Carcass, with partial head. Singe grade 2&3 on majority of flight feathers (tail, wing) and majority of dorsal body. Small area of singe on upper back.	Scorched or singed	3,3	1	640304, 3933538	Powerblock	NA
2015_200_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/6/2015	5/6/2015	Feather spot	3-6 days	Feather spot consisting of 16 body feathers. No evidence of singeing or collision. Feather spot size small.	Unknown	NA	2	639359, 3936782	Heliostat	NA
2015_201_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/6/2015	5/6/2015	Feather spot	3-6 days	Feather spot consisting of 6 flight feathers and 8 contour feathers. Evidence of singeing on flight feathers. Flux grade effect 1. Feather size spot small.	Scorched or singed	1	1	640355, 3933511	Powerblock	NA
2015_202_ISEGS	Wilson's Warbler	WIWA	Carcass Survey	5/6/2015	5/6/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass found. Evidence of singeing on flight feathers, nape, left side of face, flanks, and rump. Flux grade effect 2 & 3.	Scorched or singed	3,3	1	640370, 3933546	ACC Building	NA
2015_203_ISEGS	Mourning Dove	MODO	Carcass Survey	5/6/2015	5/6/2015	Feather spot	3-6 days	Feather spot consisting of tail and ~ 500 body feathers. No evidence of singeing or collision. Feather size spot small.	Unknown	NA	1	640183, 3933448	Heliostat	NA
2015_214_ISEGS	Wilson's Warbler	WIWA	Incidental	5/13/2015	5/13/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. No evidence of singeing or collision.	Unknown	NA	2	639403, 3934893	Overhead Lines	NA
2015_215_ISEGS	Wilson's Warbler	WIWA	Incidental	5/13/2015	5/13/2015	Dead, fresh (eyes moist)	0-8 hours	Whole carcass found. Evidence of vehicular collision supported by fractured neck and location in road. No singe.	Collision (other)	NA	NA	640158, 3935360	Power Pole	NA
2015_216_ISEGS	Unknown hummingbird	UNHU	Incidental	5/14/2015	5/14/2015	Broken up	7 days	Carcass intact, excepting tail. All present feathers show sign o singe and/or curl - grade 2 &3.	Scorched or singed	3,3	2	638652, 3935829	Powerblock	NA
2015_217_ISEGS	Unknown Passerine	UNPA	Incidental	5/14/2015	5/14/2015	Mummified	1 month +	Carcass intact but completely desiccated and heavily weathered. Singe grade 3 on covert feathers.	Scorched or singed	3	2	638581, 3935892	Powerblock	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_218_ISEGS	MacGillivray's Warbler	MGWA	Carcass Survey	5/18/2015	5/18/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Extensive (Grade 2 & 3) singe on entire carcass (breast, head, wing) and flight feathers, excepting central dorsal (belly) area, which is the only area without singe.	Scorched or singed	3,3	1	640352, 3933520	ACC Building	NA
2015_219_ISEGS	Yellow Warbler	YWAR	Carcass Survey	5/18/2015	5/18/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Curling on majority of secondary and primary wing feathers. Singe and curl on tail, left wing, and small amount of singe on head, scapular, and rump. Flux grade 1 & 3.	Scorched or singed	1,3	1	640358, 3933534	ACC Building	NA
2015_220_ISEGS	Mourning Dove	MODO	Carcass Survey	5/18/2015	5/18/2015	Broken up	2 weeks	Partial carcass (one wing, head, keel, legs). No evidence of singe/collision. Body desiccated.	Unknown	NA	1	640348, 3933556	Powerblock	NA
2015_221_ISEGS	Calliope Hummingbird	CAHU	Carcass Survey	5/18/2015	5/18/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Singe, flux grade 3, on rump and upper tail coverts.	Scorched or singed	3	1	640404, 3933520	Powerblock	NA
2015_222_ISEGS	Yellow Warbler	YWAR	Carcass Survey	5/19/2015	5/19/2015	Feather spot	7 days	Feather spot = small. 4 primaries, 5 secondaries, 20 contour feathers found. No singe.	Unknown	Unk	1	640362, 3933560	Powerblock	NA
2015_223_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/19/2015	5/19/2015	Feather spot	3-6 days	Feather spot = large. 4 primaries, 5 secondaries, 1 tail feather found. Curling and singe on 5 of the 10 found feathers.	Scorched or singed	3,3	1	640363, 3933508	Powerblock	NA
2015_224_ISEGS	MacGillivray's Warbler	MGWA	Carcass Survey	5/19/2015	5/19/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass, no singe. Imprint matching size found on nearest heliostat. Upper mandible broken at tip.	Collision with solar panel/heliostat	NA	1	640363, 3933357	heliostat	NA
2015_225_ISEGS	Greater Roadrunner	GRRO	Carcass Survey	5/19/2015	5/19/2015	Broken up	3-6 days	Feather spot with partial carcass fragments. 50 body feathers, 10 retrices, 30 wing feathers, pieces of mandible, skull. No singe.	Unknown	NA	1	639350, 3933643	Fencing	NA
2015_226_ISEGS	Greater Roadrunner	GRRO	Carcass Survey	5/19/2015	5/19/2015	Feather spot	7 days	Feather spot = large. 10 retrices and 2 undertail coverts. No singe.	Unknown	NA	1	641221, 3932845	Fencing	NA
2015_227_ISEGS	MacGillivray's Warbler	MGWA	Carcass Survey	5/19/2015	5/19/2015	Broken up	0-8 hours	Partial carcass and feather spot. Feather spot = small. 200 body, tail, and wing feathers, 2 partial wings, full tail, 1 leg found. No singe.	Unknown	NA	1	640746, 3933686	heliostat	NA
2015_228_ISEGS	Unknown Swallow	UNSW	Carcass Survey	5/19/2015	5/19/2015	Feather spot	7 days	Feather spot = small. 15 contour feathers, 5 primaries, 8 secondaries found. Singe and curl on secondaries.	Scorched or singed	1	1	640362, 3933559	Powerblock	NA

USFWS #	Common Name	Species Code	How Found	Detection Date	Collection Date	Condition	Time Since Death/Injury	Description of Carcass/Injury	Cause of Death/Injury	Burn Grade	Unit	UTM Coordinates	Nearest Project Feature	SPUT Revisions
2015_229_ISEGS	Unknown Passerine	UNPA	Carcass Survey	5/19/2015	5/19/2015	Broken up	3-6 days	Feather spot = small. Partial right wing with flesh and 3 primaries from left wing. Singe at tips of 5 flight feathers, Grade 1.	Scorched or singed	1	1	640362, 3933559	Powerblock	NA
2015_230_ISEGS	Common Raven	CORA	Incidental	5/20/2015	5/20/2015	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Burned on feet and throughout ventral body and on bill. Strong burning odor when collected. Found under transmission line, apparent electrocution. Exit wounds on feet typical of electrocution death. No flux related singe evident.	Electrocution	NA	NA	639665, 3934427	Power Pole	NA
2015_231_ISEGS	Bullock's Oriole	BUOR	Carcass Survey	5/21/2015	5/20/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No singe. Found with broken bill near heliostat. Heavily scavenged by ants.	Collision with solar panel/heliostat	NA	1	640977, 3934333	heliostat	NA

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

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_047_ISEGS	GWTE	Outer Segment	1140	Large	Feather Spot	collision	Fatality Search	17	Yes				X			
2015_048_ISEGS	WCSP	Outer Segment	940	Small	Small Carcass	collision	Fatality Search	17	Yes				X			
2015_049_ISEGS	RUHU	Power Block	40	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_050_ISEGS	UNPA	Inner Segment	639	Small	Feather Spot	unknown	Fatality Search	20	No				X			Older than Search Interval
2015_051_ISEGS	BTSP	Overhead Lines	1033	Small	Small Carcass	unknown	Incidental	15	Yes						X	
2015_052_ISEGS	GRRO	Outer Segment	1028	Large	Large Carcass	collision	Incidental	NA	No				X			Outside Standard Search Area
2015_053_ISEGS	EAGR	Power Block	0	Large	Large Carcass	collision	Incidental	1(1)	Yes	X	X					
2015_054_ISEGS	NRWS	Power Block	33	Small	Small Carcass	unknown	Fatality Search	5	No	X	X					Older than Search Interval
2015_055_ISEGS	VGSW	Inner HD	199	Small	Feather Spot	singed	Fatality Search	22	Yes	X		X				
2015_056_ISEGS	BTGN	Outer Segment	1411	Small	Feather Spot	unknown	Fatality Search	5	No				X			Older than Search Interval
2015_057_ISEGS	AMWI	Inner Segment	662	Large	Large Carcass	unknown	Fatality Search	21	Yes				X			
2015_058_ISEGS	MODO	Inner HD	200	Large	Feather Spot	unknown	Fatality Search	16	No	X		X				Older than Search Interval
2015_059_ISEGS	GRRO	Unit Fences	1148	Large	Feather Spot	unknown	Fatality Search	16	Yes							
2015_060_ISEGS	BTSP	Outer Segment	1107	Small	Small Carcass	unknown	Fatality Search	15	Yes				X			
2015_061_ISEGS	BRSP	Inner Segment	623	Small	Small Carcass	unknown	Fatality Search	17	Yes				X			
2015_062_ISEGS	WCSP	Inner Segment	529	Small	Small Carcass	unknown	Fatality Search	17	Yes				X			
2015_063_ISEGS	NRWS	Power Block	75	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_064_ISEGS	RCKI	Power Block	67	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_065_ISEGS	LEGO	Power Block	15	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_066_ISEGS	MODO	Outer Segment	1470	Large	Feather Spot	unknown	Fatality Search	11	No				X			Older than Search Interval
2015_067_ISEGS	GWTE	Outer Segment	1395	Large	Feather Spot	unknown	Fatality Search	7	No				X			Older than Search Interval
2015_068_ISEGS	NRWS	Power Block	113	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_069_ISEGS	TRES	ACC	43	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_070_ISEGS	VERD	ACC	40	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_071_ISEGS	YRWA	ACC	61	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_072_ISEGS	YRWA	ACC	67	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_073_ISEGS	COHA	Outer Segment	723	Large	Large Carcass	unknown	Incidental	NA	No				X			Outside Standard Search Area

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_074_ISEGS	EAGR	Outside Search - COMMONS E/HAB	1615	Large	Feather Spot	unknown	Incidental	NA	No							Outside Standard Search Area
2015_075_ISEGS	BTSP	Outer Segment	1163	Small	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_076_ISEGS	CITE	Unit Fences	1192	Large	Feather Spot	collision	Fatality Search	23	Yes							
2015_077_ISEGS	GRRO	Outer Segment	1046	Large	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_078_ISEGS	CLSW	ACC	61	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_079_ISEGS	UNSW	Power Block	34	Small	Feather Spot	unknown	Fatality Search	7	Yes	X	X					
2015_080_ISEGS	YRWA	Power Block	65	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_081_ISEGS	YRWA	Power Block	75	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_082_ISEGS	NRWS	Power Block	124	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_083_ISEGS	YRWA	Inner HD	1340	Small	Small Carcass	singed	Fatality Search	7	Yes	X		X				
2015_084_ISEGS	YRWA	Inner HD	1230	Small	Small Carcass	singed	Fatality Search	7	Yes	X		X				
2015_085_ISEGS	UNPA	ACC	48	Small	Small Carcass	singed	Fatality Search	7	No	X	X					Older than Search Interval
2015_086_ISEGS	VGSW	ACC	50	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_087_ISEGS	COHU	Power Block	90	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_088_ISEGS	AMKE	Power Block	89	Large	Feather Spot	singed	Fatality Search	7	No	X	X					Older than Search Interval
2015_089_ISEGS	LENI	Inner HD	237	Small	Small Carcass	unknown	Fatality Search	7	Yes	X		X				
2015_090_ISEGS	RUHU	ACC	40	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_091_ISEGS	HOLA	Outer Segment	1287	Small	Small Carcass	unknown	Incidental	7	No				X			Outside Standard Search Area
2015_092_ISEGS	HOLA	Outer Segment	12860	Small	Small Carcass	unknown	Incidental	7	No				X			Outside Standard Search Area
2015_093_ISEGS	AMRO	Outer Segment	767	Small	Feather Spot	unknown	Incidental	NA	No				X			Outside Standard Search Area
2015_094_ISEGS	CACW	Outer Segment	1115	Small	Feather Spot	collision	Fatality Search	7	No				X			Older than Search Interval
2015_095_ISEGS	NRWS	Power Block	0	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_096_ISEGS	BANS	Power Block	85	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_097_ISEGS	AMKE	Inner Segment	587	Large	Large Carcass	singed	Fatality Search	7	Yes				X			
2015_098_ISEGS	YRWA	ACC	73	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_099_ISEGS	UNHU	Power Block	61	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_100_ISEGS	BGGN	Inner HD	238	Small	Small Carcass	collision	Fatality Search	7	Yes	X		X				
2015_101_ISEGS	YRWA	Inner HD	205	Small	Small Carcass	collision	Fatality Search	7	Yes	X		X				

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_102_ISEGS	YRWA	Power Block	49	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_103_ISEGS	YRWA	ACC	49	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_104_ISEGS	UNHU	ACC	35	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_105_ISEGS	RCKI	Power Block	87	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_106_ISEGS	YRWA	Power Block	97	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_107_ISEGS	YRWA	Inner Segment	562	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_108_ISEGS	LENI	Inner HD	242	Small	Feather Spot	collision	Fatality Search	7	Yes	X		X				
2015_109_ISEGS	UNPA	Outer Segment	1075	Small	Feather Spot	unknown	Fatality Search	6	Yes				X			
2015_110_ISEGS	UNHU	Power Block	38	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_111_ISEGS	HOWR	Inner HD	223	Small	Feather Spot	unknown	Fatality Search	7	Yes	X		X				
2015_112_ISEGS	UNPA	Power Block	32	Small	Feather Spot	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_113_ISEGS	BRSP	Outer Segment	1194	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_114_ISEGS	BTSP	Outer Segment	1350	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_115_ISEGS	NRWS	Power Block	122	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_116_ISEGS	UNPA	Power Block	82	Small	Feather Spot	unknown	Fatality Search	7	Yes	X	X					
2015_117_ISEGS	YRWA	Power Block	86	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_118_ISEGS	WIWA	Power Block	50	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_119_ISEGS	YRWA	Power Block	55	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_120_ISEGS	YRWA	Power Block	47	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_121_ISEGS	YRWA	Power Block	47	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_122_ISEGS	YRWA	Power Block	54	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_123_ISEGS	YRWA	Power Block	59	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_124_ISEGS	YRWA	Power Block	60	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_125_ISEGS	YRWA	Power Block	71	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_126_ISEGS	YRWA	Power Block	77	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_127_ISEGS	YRWA	Power Block	33	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_128_ISEGS	YRWA	Power Block	NA	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_129_ISEGS	YRWA	Power Block	13	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_130_ISEGS	YRWA	Power Block	22	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_131_ISEGS	RUHU	Power Block	75	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_132_ISEGS	YRWA	Power Block	24	Small	Small Carcass	unknown	Incidental	1(1)	Yes	X	X					
2015_133_ISEGS	YRWA	Power Block	30	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_134_ISEGS	CAHU	Power Block	20	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_135_ISEGS	YRWA	Power Block	120	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_136_ISEGS	COHU	Power Block	25	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_137_ISEGS	CHSP	Power Block	49	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_138_ISEGS	CHSP	Power Block	40	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_139_ISEGS	CAHU	Power Block	58	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_140_ISEGS	MODO	Outer Segment	1353	Large	Large Carcass	collision	Fatality Search	14	Yes				X			
2015_141_ISEGS	OCWA	Power Block	76	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_142_ISEGS	YRWA	Power Block	65	Small	Small Carcass	singed	Fatality Search	7	No	X	X					Older than Search Interval
2015_143_ISEGS	WEME	Outer Segment	691	Small	Feather Spot	unknown	Fatality Search	14	Yes				X			
2015_144_ISEGS	MODO	Outside Search - ADMISTRATIVE BUILDING FENCE	968	Large	Large Carcass	unknown	Incidental	NA	No							Outside Standard Search Area
2015_145_ISEGS	WEME	Outer Segment	1184	Small	Small Carcass	collision	Fatality Search	6	No				X			Older than Search Interval
2015_146_ISEGS	CAHU	Power Block	71	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_147_ISEGS	OCWA	Power Block	21	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_148_ISEGS	SAVS	Outer Segment	1169	Small	Feather Spot	unknown	Fatality Search	6	No				X			Older than Search Interval
2015_149_ISEGS	UNPA	Inner Segment	470	Small	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_150_ISEGS	BCHU	Power Block	30	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_151_ISEGS	LENI	Outer Segment	714	Small	Feather Spot	unknown	Fatality Search	8	Yes				X			
2015_152_ISEGS	WWDO	Outer Segment	754	Large	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_153_ISEGS	SAVS	Outer Segment	753	Small	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_154_ISEGS	OCWA	ACC	30	Small	Small Carcass	singed	Fatality Search	8	Yes	X	X					
2015_155_ISEGS	UNPA	Power Block	37	Small	Feather Spot	singed	Fatality Search	8	Yes	X	X					
2015_156_ISEGS	YHBL	Power Block	27	Small	Feather Spot	unknown	Fatality Search	8	Yes	X	X					
2015_157_ISEGS	YHBL	Outer Segment	857	Small	Small Carcass	collision	Incidental	NA	No				X			Outside Standard Search Area

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_158_ISEGS	YRWA	Outer Segment	866	Small	Small Carcass	unknown	Incidental	NA	No				X			Outside Standard Search Area
2015_159_ISEGS	UNPA	Outside Search - TORTOISE PENS	945	Small	Small Carcass	unknown	Incidental	NA	No							Outside Standard Search Area
2015_160_ISEGS	HOLA	Inner Segment	283	Small	Small Carcass	unknown	Fatality Search	6	Yes				X			
2015_161_ISEGS	YRWA	ACC	118	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_162_ISEGS	ROPI	Inner HD	225	Large	Feather Spot	singed	Fatality Search	7	Yes	X		X				
2015_163_ISEGS	RUHU	ACC	136	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_164_ISEGS	MODO	Unit Fences	1275	Large	Feather Spot	unknown	Incidental	7	Yes							
2015_165_ISEGS	WIWA	ACC	60	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_166_ISEGS	YRWA	Power Block	72	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_167_ISEGS	YRWA	Inner HD	242	Small	Small Carcass	singed	Fatality Search	7	Yes	X		X				
2015_168_ISEGS	BARS	Power Block	79	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_169_ISEGS	CAHU	Power Block	40	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_170_ISEGS	LAZB	Inner Segment	600	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_171_ISEGS	UNPA	Power Block	218	Small	Feather Spot	unknown	Fatality Search	6	Yes	X	X					
2015_172_ISEGS	RUHU	Power Block	99	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_173_ISEGS	UNPA	Inner Segment	478	Small	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_174_ISEGS	OCWA	Power Block	4	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_175_ISEGS	MODO	Outer Segment	1400	Large	Large Carcass	collision	Fatality Search	7	No				X			Older than Search Interval
2015_176_ISEGS	MODO	Power Block	38	Large	Feather Spot	unknown	Fatality Search	6	Yes	X	X					
2015_177_ISEGS	MODO	Outer Segment	707	Large	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_178_ISEGS	YWAR	Power Block	10	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_179_ISEGS	WIWA	Power Block	37	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_180_ISEGS	CAHU	Power Block	74	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2015_181_ISEGS	BTSP	Outer Segment	1144	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_182_ISEGS	AMCO	Outer Segment	926	Large	Large Carcass	unknown	Incidental	NA	No				X			Outside Standard Search Area
2015_183_ISEGS	CAHU	ACC	63	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_184_ISEGS	COHU	ACC	65	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_185_ISEGS	YRWA	Inner HD	163	Small	Small Carcass	singed	Fatality Search	7	No	X		X				Older than Search Interval

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_186_ISEGS	MODO	Outer Segment	986	Large	Large Carcass	collision	Fatality Search	7	Yes				X			
2015_187_ISEGS	CAHU	Power Block	42	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_188_ISEGS	CAHU	Power Block	49	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_189_ISEGS	UNPA	Power Block	53	Small	Feather Spot	singed	Fatality Search	7	Yes	X	X					
2015_190_ISEGS	RUHU	Power Block	57	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_191_ISEGS	UNPA	Power Block	81	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_192_ISEGS	MODO	Outer Segment	1120	Large	Large Carcass	collision	Fatality Search	7	Yes				X			
2015_193_ISEGS	CAHU	ACC	37	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_194_ISEGS	CAHU	ACC	64	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_195_ISEGS	YRWA	ACC	65	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_196_ISEGS	BCHU	Power Block	71	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_197_ISEGS	MODO	Outer Segment	1560	Large	Large Carcass	collision	Fatality Search	7	Yes				X			
2015_198_ISEGS	UNPA	Outer Segment	1056	Small	Small Carcass	unknown	Fatality Search	7	No				X			Older than Search Interval
2015_199_ISEGS	COHU	Power Block	83	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_200_ISEGS	UNPA	Outer Segment	1206	Small	Feather Spot	unknown	Fatality Search	7	Yes				X			
2015_201_ISEGS	UNPA	Power Block	29	Small	Feather Spot	singed	Fatality Search	7	Yes	X	X					
2015_202_ISEGS	WIWA	ACC	60	Small	Small Carcass	singed	Fatality Search	7	Yes	X	X					
2015_203_ISEGS	MODO	Inner HD	193	Large	Feather Spot	unknown	Fatality Search	7	Yes	X		X				
2015_204_ISEGS	TOWA	Outer Segment	853	Small	Small Carcass	collision	Fatality Search	7	Yes				X			
2015_205_ISEGS	WETA	Outside Search - Colosseum Road	918	Small	Small Carcass	collision	Incidental	NA	No							Outside Standard Search Area
2015_206_ISEGS	TOWA	Overhead Lines	1030	Small	Small Carcass	unknown	Incidental	3	Yes						X	
2015_207_ISEGS	BTSP	Outer Segment	1026	Small	Small Carcass	collision	Fatality Search	8	Yes				X			
2015_208_ISEGS	WETA	Outer Segment	1025	Small	Small Carcass	unknown	Fatality Search	7	Yes				X			
2015_209_ISEGS	BTSP	ACC	68	Small	Small Carcass	singed	Fatality Search	6	Yes	X	X					
2015_210_ISEGS	CAHU	Power Block	40	Small	Small Carcass	singed	Fatality Search	6	Yes	X	X					
2015_211_ISEGS	SNEG	Outer Segment	1048	Large	Large Carcass	collision	Incidental	NA	No				X			Outside Standard Search Area
2015_212_ISEGS	BHGR	Overhead Lines	1035	Small	Small Carcass	collision	Fatality Search	8	Yes						X	
2015_213_ISEGS	MODO	Inner Segment	647	Large	Feather Spot	unknown	Fatality Search	7	Yes				X			

USFWS #	Species Code	Location	Distance from Tower (m)	Bird Size	Model Size	Cause of Death	How Found	Time Since Last Survey (days)	Used in Estimator	Tower Area	Power Block	Inner HD	Heliostat Area	Unit Fence	Overhead Lines	Estimator Notes
2015_214_ISEGS	WIWA	CLA Fence	1252	Small	Small Carcass	unknown	Fatality Search	8	Yes					X		
2015_215_ISEGS	WIWA	Outside Search - Outside Fenceline of Unit 2 to the SE	3384	Small	Small Carcass	collision	Incidental	NA	No							Outside Standard Search Area
2015_216_ISEGS	UNHU	Power Block	16	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_217_ISEGS	UNPA	Power Block	90	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_218_ISEGS	MGWA	ACC	40	Small	Small Carcass	singed	Fatality Search	12	Yes	X	X					
2015_219_ISEGS	YWAR	ACC	48	Small	Small Carcass	singed	Fatality Search	12	Yes	X	X					
2015_220_ISEGS	MODO	Power Block	73	Large	Large Carcass	unknown	Fatality Search	12	No	X	X					Older than Search Interval
2015_221_ISEGS	CAHU	Power Block	45	Small	Small Carcass	singed	Fatality Search	12	Yes	X	X					
2015_222_ISEGS	YWAR	Power Block	74	Small	Feather Spot	unknown	Fatality Search	1	No	X	X					Older than Search Interval
2015_223_ISEGS	UNPA	Power Block	22	Small	Feather Spot	singed	Fatality Search	1	No	X	X					Older than Search Interval
2015_224_ISEGS	MGWA	Inner HD	127	Small	Small Carcass	collision	Fatality Search	13	Yes	X		X				
2015_225_ISEGS	GRRO	Unit Fences	1034	Large	Feather Spot	unknown	Fatality Search	13	Yes							
2015_226_ISEGS	GRRO	Unit Fences	1070	Large	Feather Spot	unknown	Fatality Search	13	Yes							
2015_227_ISEGS	MGWA	Inner Segment	435	Small	Feather Spot	unknown	Fatality Search	20	Yes				X			
2015_228_ISEGS	UNSW	Power Block	72	Small	Feather Spot	singed	Fatality Search	1	No	X	X					Older than Search Interval
2015_229_ISEGS	UNPA	Power Block	73	Small	Feather Spot	singed	Fatality Search	1	No	X	X					Older than Search Interval
2015_230_ISEGS	CORA	Outside Search - Commons East	1170	Large	Large Carcass	electrocution	Incidental	NA	No							Outside Standard Search Area
2015_231_ISEGS	BUOR	Outer Segment	1038	Small	Small Carcass	collision	Fatality Search	13	Yes				X			