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Filer:	Joe Douglas
Organization:	Western EcoSystems Technology, Inc. for Solar Partners I, II, and VIII
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IVANPAH SOLAR ELECTRIC GENERATING SYSTEM
AVIAN & BAT MONITORING PLAN

2015 – 2016 WINTER REPORT

Prepared for:

Solar Partners I, II, and VIII

100302 Yates Well Road

Nipton, CA 92364

Prepared by:

Western EcoSystems Technology, Inc.

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415 W. 17th Street, Suite 200, Cheyenne, WY 82001 ◆ Ph: 307-634-1756 ◆ F: 307-637-6981

Executive Summary

Avian and bat monitoring surveys were conducted from 21 October 2015 to 25 March 2016 (the winter 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) as revised November 2015.

Per the revised Plan, potential flux effects are to be investigated by surveying 100 percent of the tower area in all three units, and collisions with facility structures (towers and heliostats) are to be evaluated by systematic sampling of 100% of the tower areas (154 acres) in each of the three units, and 20% of Unit 2 heliostat field (240 acres) as representative of the facility. The "tower area" consists of the power block and inner high-density (HD) heliostats surrounding each power block on approximately 154 acres; and 2) the "heliostat area" consists of the inner and outer heliostat segments outside of the inner HD heliostats on approximately 2,991 acres. Searches were conducted within the winter season at intervals of approximately 21 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 21 October 2015 – 25 March 2016, a total of 3 bat detections, and 110 avian detections (including 2 injured birds), were found.

According to the specifications of the revised Plan, the number of avian detections was categorized by facility structure and cause. These avian fatality search results, along with searcher efficiency and carcass removal 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 21 October 2015 – 25 March 2016, there were an estimated 133 fatalities (10.1%) from known causes and 1185 fatalities (89.9%) from unknown causes. Of the known causes, 113 fatalities (85%) were estimated for the 154-acre tower area. The number of known cause detections in the 2,991-acre heliostat area was not greater than five, thus a separate estimate for this area is not provided. However, all known cause detections (including those from the heliostat area) are included in the total known cause fatality estimate.

Of the unknown causes, 108 fatalities (9.1%) were estimated for the tower area, 1077 fatalities (90.9%) were estimated for the heliostat area. Driving this estimate was a large number of feather spots (23) comprising all but 2 (92%) of the unknown-cause detections in the heliostat area, which may lead to an over-estimate of fatalities with unknown causes. Overall, based on the monitoring results and estimates for known causes for the winter season, the effect of the Project on birds will not rise above the "low" category.

Table of Contents

Figures

Tables

Appendices

Section 1.0 Introduction

1.1 Project Background

The Ivanpah Solar Electric Generating System (referred to in this report as "Ivanpah" or "Project") 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 was prepared by the Project proponent in collaboration with the Technical Advisory Committee (TAC) made up of 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. Revision 12 of the Plan (2013) was accepted by the TAC in November 2013 and required two years of monitoring, which were completed at the end of October 20, 2015. As determined by the TAC, the goals of the Plan (2013) were met, and in November 2015, the TAC-approved Revision 13 to the Plan (2015) to require a third year of monitoring to provide collision and flux mortality estimates. Revision 13 of the Plan (2015) reflects reduced monitoring requirements as informed by the first two years of intensive monitoring. Specifically, the Plan (2015) 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 provides the following goals and objectives as excerpted from the Plan (2015):

Plan Goals

1. Provide Collision Mortality Estimates: Estimates of avian mortality from collision will be calculated from data obtained by monitoring and identifying avian mortality and injury associated with facility structure collisions.
2. Provide Solar Flux Mortality Estimates: Estimates of avian mortality from flux effects will be calculated from data obtained by monitoring and identifying avian mortality and injury associated with solar flux generated by the facility.
3. Provide a Framework for Management and Response to Risks**:** The designation and description of the functioning of the TAC provides a management and decision framework for the identification and implementation of potential adaptive management measures.

Plan Objectives

The first two years of monitoring documented that the mortality associated with the perimeter fences, transmission lines, and offsite transects was less than 5 detections a season. Additionally, the patterns associated with avian use have been consistent over the seasons and documented in the annual reports. Therefore, as revised, this plan has the following goals:

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

   a. Power towers
   b. Heliostats

2. Estimate flux-related avian mortality and injury using empirical data to calculate facility-wide mortality and injury rates.
3. Document patterns of collision or flux-related mortality and injury associated with species, age/sex, season, weather, and visibility.
4. Document spatial patterns associated with collision- or flux-related mortality and injury.
5. Provide quantitative information for developing and implementing adaptive management responses commensurate with identified impacts.

The revised Plan (2015) continues 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).

1.3 Purpose of This Report

This report represents the first "quarterly" (i.e., seasonal) report for the third year of monitoring (or, the ninth 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 winter 2015 – 2016 season, which includes the period from 21 October, 2015 through 25 March, 2016.

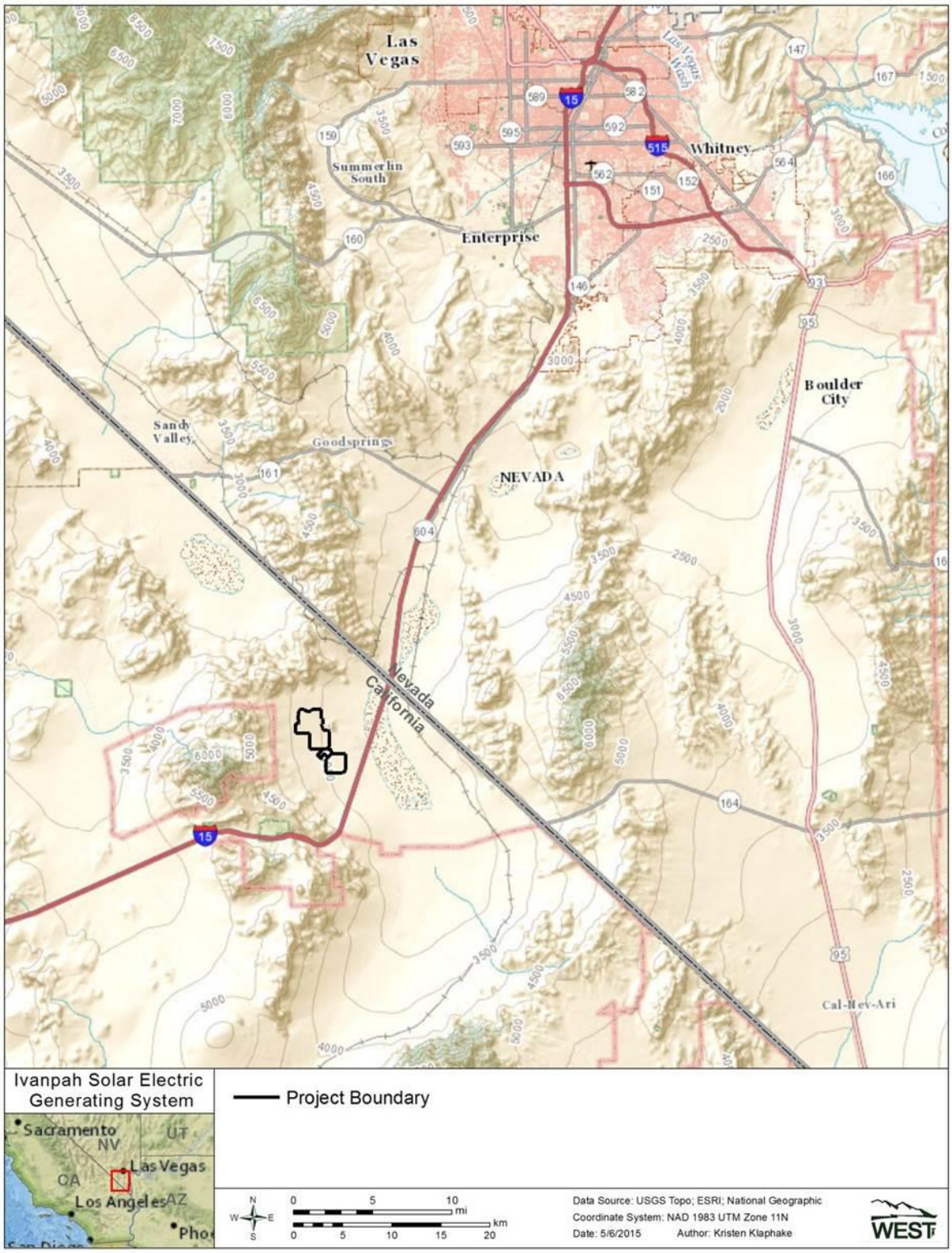

Figure 1. Ivanpah Vicinity Map.

Section 2.0 Methods

The Plan (2015) describes the methods by which monitoring and certain analyses, including compilation of the overall fatality estimate, will occur. Below is an abridged description (see Plan (2015) for detailed methods), with greater detail provided when methods differ from original Plan (2013).

2.1 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 removal and searcher efficiency trials; how data were reported and analyzed for incidental detections; and the methods for producing fatality estimates for the Project.

2.1.1 Standardized Searches

2.1.1.1 Areas Surveyed

Per the Plan (2015), monitoring was conducted in the "tower area" and a sample of the "heliostat area". The tower area is 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. . The heliostat area is defined as the inner and outer heliostat segments outside of the inner HD heliostats. For year 3, 100% of the tower area at each unit was surveyed and 20% of the Unit 2 heliostat area (8% of the total heliostat area) was surveyed. Table 1a provides the acreage searched within each of the survey areas, as well as the percent of the facility comprised by these search areas. Overall, approximately 12.9% of the Project was searched (Figure 2).

To ensure a balanced distribution of heliostat field survey plots, Unit 2 was divided into inner and outer heliostat fields, and approximately 20% of each sub-area was randomly selected for monitoring. Arc plots used for monitoring in Unit 2 were the same as previous years. This stratified random sampling design ensures that survey plots will not be clustered or biased in any distance or direction from the tower.

Table 1a. Monitoring Areas, 2015-2016 Winter Season.

Area	Facility Locations Included	Acreage Searched	Percent of Facility
Tower Area	ACC, Power Block, Inner HD	154	4.80%
Heliostat Area	Unit 2 Inner and Outer Heliostat Segments	240	8.09%
Total		394	12.89%

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

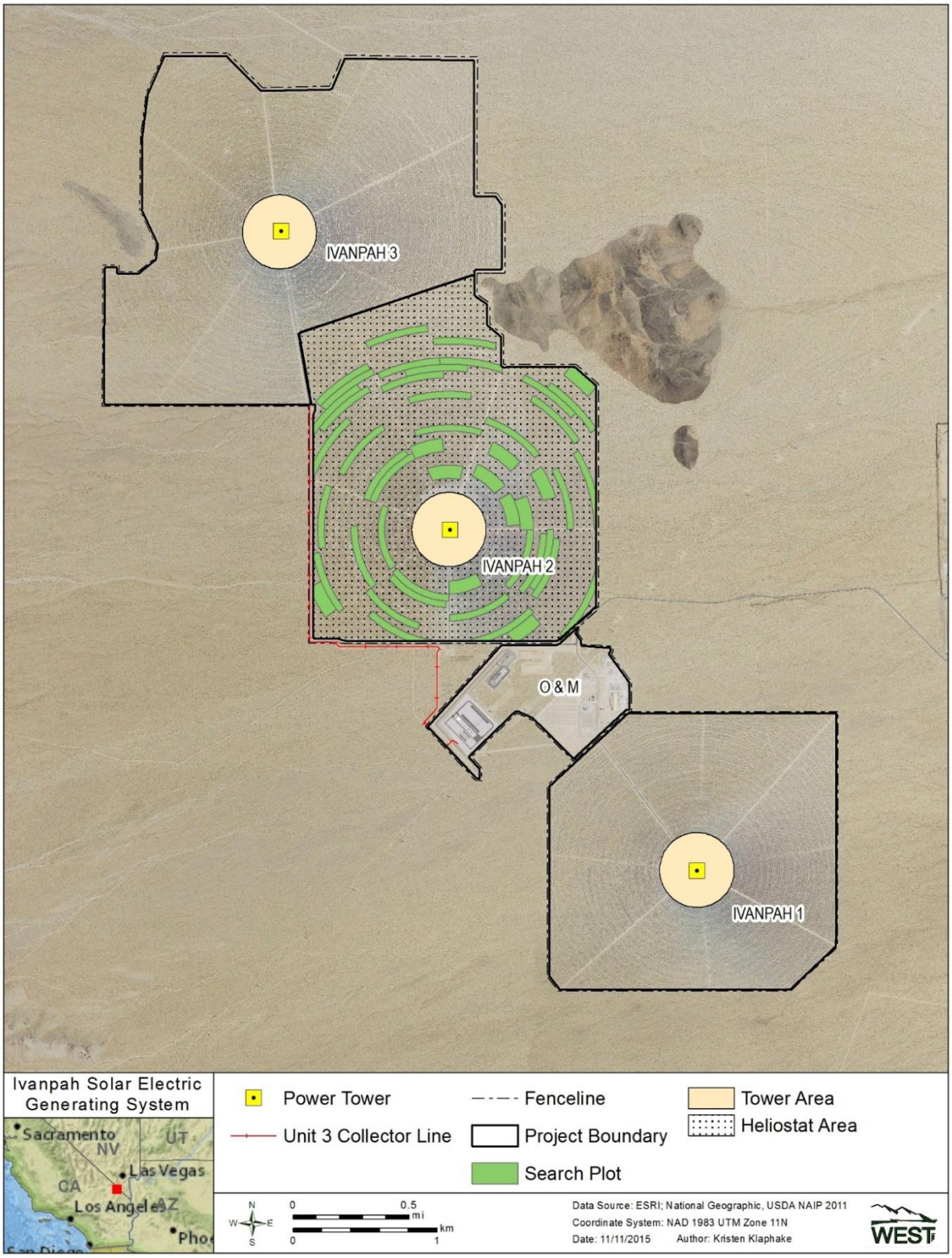

Figure 2. Ivanpah Search Areas.

2.1.1.2 Search Frequency and Timing

Consistent with the first two years of monitoring, standardized searches occurred at each unit on a nominal 21-day interval through the 2015 – 2016 winter season. Variation in search interval and number of visits to each unit was anticipated to occur due to the transition between 21-day search and 7-day search interval between seasons of differing length, as well as the transition to Revision 13 of the Plan (2015), after November 15, 2015. The tower areas of Units 1, 2 and 3 were visited a total of eight times, and the inner and outer heliostat segments of Unit 2 was visited 9 times.

2.1.1.3 Search Methods

Biologists performed surveys in the tower area, and plots in the heliostat area. Standardized walking surveys for fatalities were performed by biologists approved by CEC and BLM, in accordance with the methods outlined in the Plan (2015). 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 3). 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.

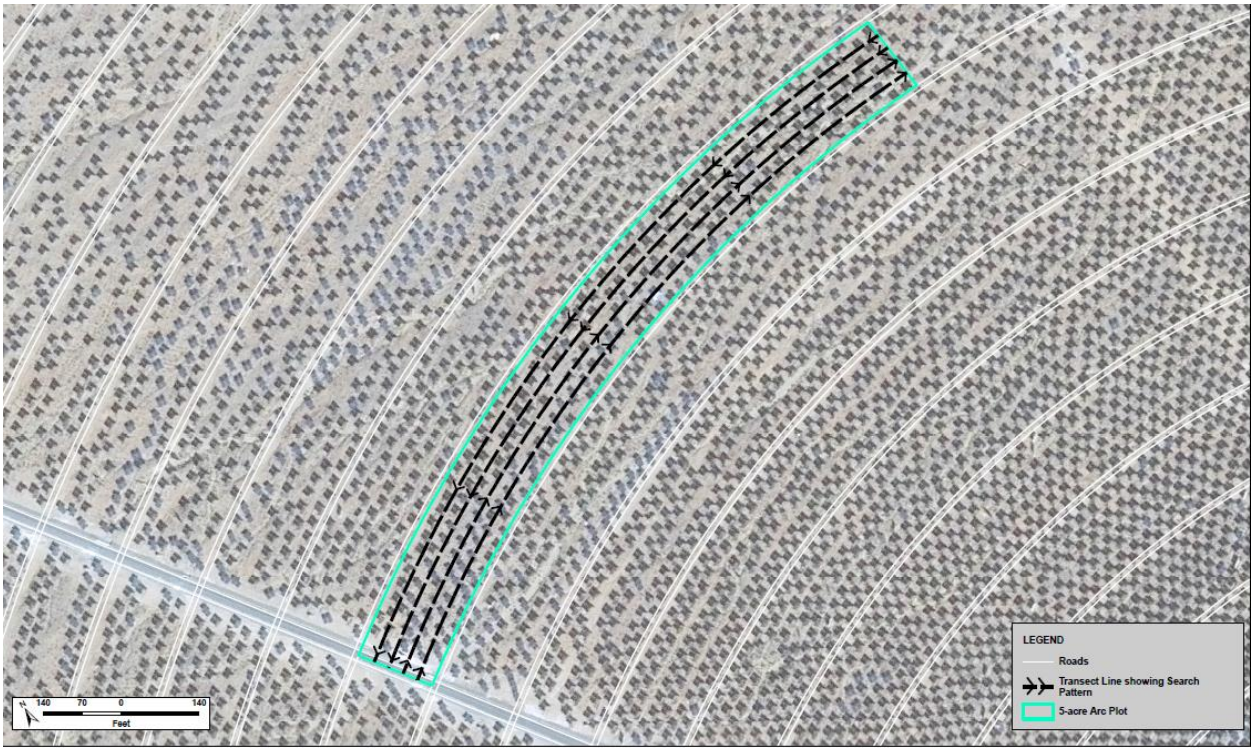

Figure 3. Monitoring Search Pattern for Arc Plots.

Carcass and Feather Spot Examination. Every carcass and feather spot was examined visually by a biologist approved by the CEC and BLM 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 definition:

> 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.

2.1.2 Carcass Persistence Trials

Carcass persistence trials were performed throughout the 2015 – 2016 winter monitoring season. A total of 30 small bird carcass trials were conducted. The TAC approved discontinuing large bird carcass trials at the conclusion of the 2015 summer season due to the consistency of large bird persistence times collected over the previous seasons. In response to the previous TAC request of increased sample size, the number of small bird trials was increased relative to the 2013 – 2014 winter monitoring season.

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 10 carcasses placed in the unvegetated tower area, and 21 carcasses placed in the vegetated heliostat arrays. Non-native house sparrows (*Passer domesticus*) were used for small carcass trials conducted during the 2015 – 2016 winter monitoring season. A camera was placed at each carcass to record the time of scavenging and the scavenging species.

2.1.3 Searcher Efficiency Trials

A total of 83 searcher efficiency trials (33 small birds, 24 large birds, and 26 feather spots) were conducted during the 2015 – 2016 winter 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 tower areas of all three units and in the heliostat area of Unit 2; however, no trials were placed in the ACC building since detection probability is assumed to be 100% in this area of the power block. Each trial carcass was placed by a Designated Biologist prior to a scheduled search without knowledge of the searchers. For trial carcasses that were not detected by searchers, the Designated Biologist returned to the trial location to determine if the trial carcass was still available to be found. If the trial carcass was absent, it was assumed to have been removed prior to the search, and thus not available to be detected.

Overall, 50 trial carcasses/feather spots were placed in the tower area and 33 trial carcasses were placed in vegetated areas in the inner/outer segments of the heliostat area. Of the 83 trial carcasses placed, 69 (24 small carcasses, 22 large carcasses, and 23 feather spots) were available to be found; 14 carcasses (9 small carcasses, 2 large carcass, and 3 feather spots) were removed (scavenged) from the trial location before searchers had an opportunity to find them.

2.1.4 Incidental Reporting

Some detections were made outside standardized search areas, or were within search areas but not during standardized searches. Monitoring was conducted under Revision 12 of the Plan (2013) from 21 October – 15 November and searches occurred at facility components not searched as part of Revision 13 of the Plan (2015). Detections at locations not searched under the Plan (2015) such as the fenceline are considered incidental detections for this report. 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 could be included in the fatality estimates when they were found in areas covered during standardized surveys (e.g., tower area or along the fenceline). Incidental detections from outside the survey areas were not included in the fatality estimates as discussed in Section 2.2.5; however, all detections regardless of the method or source of detection are reported in the SPUT permit database.

2.1.5 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 written 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 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. Measurement of carcass persistence time is 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 removal trials, the majority of scavenging times can be known precisely, and data are not censored. However, when cameras fail to record the moment of scavenging, trials are treated as interval censored between the last time the carcass was visible on the camera, and the earliest time at which it was known to be removed.

Survival regressions models are well-suited to accommodate censored carcass persistence data and are typically used to generate the average probability of persistence for fatality estimation (Huso et. al 2012).

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 removal 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.

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

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

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 8). 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 – 2015 season through the 2015 – 2016 winter season. Separate models were also compared for detection dog searcher efficiency trials.

Fatality Estimates. Estimates for the number of detections in the tower area components (i.e., the power block and inner HD heliostats) are reported combined, because 100% of these areas were searched. A separate estimate was produced for the heliostat area of all three Units (the inner and outer heliostat segments combined), in which 8% 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 0.08).

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 are considered facility related, whether or not they showed evidence of singeing or collision.

Within the power block, during the 2015 – 2016 winter season, incidental detections accounted for 20.4% of the detections recorded. Thus, as previously modeled, incidentals found within the power block were included in estimates, but treated 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 (Table 1b).

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. As approved by the TAC, this method was discontinued in the 2015 fall 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 fall 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 (Table 1b).

Table 1b. Treatment of Incidental Detections by Location

Location	Search Interval	Included in Analysis?
Power Block	1 Day	Yes, if carcass age is less than 24 hours
All Other Standardized Search Areas	Calculated days between date of detection and date of previous standard search in that location	Yes, if carcass age is less than calculated search interval

All fatality estimators have limitations, particularly when fatality counts are low. In particular, when detections are fewer than five, regardless of survey effort, estimates and confidence intervals can be unstable 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 five or fewer 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 – 2016 winter 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 month was made in the inner HD of Unit 2, which had been searched seven days earlier, that carcass would be excluded from analysis.

Determining the age of a carcass was based on detailed qualitative analysis of every detection (carcasses and feather spots) recovered onsite. Qualitative analysis began with in situ aging analysis in the field by biologists approved by the CEC and BLM, followed by a more detailed analysis in the lab. In the field, biologists noted the presence of rigor mortis, condition of eyes and feathers, and condition of blood or viscera (if present). In the lab, each carcass was further examined and compared to photographs of decomposed test carcasses. The test carcasses were used to document decomposition over time at Ivanpah to better inform biologist of site-specific characteristics of avian decomposition that could be expected at the Project.

Decomposition test carcasses were placed in tamper-proof containers, exposed to onsite environmental conditions, and allowed to decompose. Carcasses used in decomposition tests were placed to account for variation in space (e.g. underneath fans in the ACC unit versus shaded under a heliostat) and time (e.g. ephemeral weather patterns). As the test carcasses aged, the biologists photographed and recorded the condition of body tissue and fluids, eyes, feathers, and indications of rigor mortis. All decomposition specimens were placed during the 2015 spring monitoring season.

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.

2.2 Deterrence Measures

2.2.1 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. Specifically, new ground-level LED lighting and spikes were installed 5 February 2015. As approved by the TAC, 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 at Unit 1. Bird Buffer was installed at Unit 2 and Unit 3 on 29 September 2015; BirdGard was installed at Unit 2 on 25

August 2015 and Unit 3 on 31 August 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.

2.2.2 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 2015 at Unit 3. After Unit 3 bat deterrence was found to be nonfunctional in November 2015, an ultrasonic testing protocol will be implemented to ensure proper function of all deterrence units.

Section 3.0 Monitoring Results

3.1 Summary of Avian Detections

The average search interval in the tower area was 18.6 days (range 7 to 29, median 19 days), and in the heliostat arrays the average search interval was 16.2 days (range 2 to 33, median 16 days), during the 2015 – 2016 winter season for the three solar units. Variation in search interval was anticipated to occur due to the transition between 7-day and 21-day search intervals associated with seasons of differing length, the transition to the monitoring protocol developed in Revision 13 of the Plan, and multiple holidays during the winter season.

During the 2015 – 2016 winter season, a total of 110 avian detections (including injured birds and incidentals) of 28 identified species (Table 2) were recorded. Approximately 59% of detections were songbirds, with 18% being other types of bird; 23% could not be identified to an appropriate level. The most numerous detection of an identified species was white-crowned sparrow followed by cactus wren and horned lark. Most detections occurred in the tower area (Figures 4, 5, 6, and 7), where approximately 154 acres were surveyed, representing 100% of the total tower area.

Table 2. Number of Individual Bird Detections, by Species, 2015 – 2016 Winter Season.

Species	Scientific Name	Injuries	Fatalities	Songbird?
unidentified bird (small)		0	25	NA
white-crowned sparrow	*Zonotrichia leucophrys*	0	9	Yes
unidentified sparrow		0	6	Yes
cactus wren	*Campylorhynchus brunneicapillus*	0	6	Yes
horned lark	*Eremophila alpestris*	0	6	Yes
tree swallow	*Tachycineta bicolor*	0	5	Yes
Costa's hummingbird	*Calypte costae*	0	5	No
unidentified warbler		0	3	Yes
western meadowlark	*Sturnella neglecta*	1	3	Yes
violet-green swallow	*Tachycineta thalassina*	0	3	Yes
Anna's hummingbird	*Calypte anna*	0	3	No
greater roadrunner	*Geococcyx californianus*	0	2	No
black-throated sparrow	*Amphispiza bilineata*	0	2	Yes
American pipit	*Anthus rubescens*	0	2	Yes
house finch	*Haemorhous mexicanus*	0	2	Yes
barn swallow	*Hirundo rustica*	0	2	Yes
ruby-crowned kinglet	*Regulus calendula*	0	2	Yes
yellow warbler	*Setophaga petechia*	0	2	Yes
American kestrel	*Falco sparverius*	0	2	No
northern flicker	*Colaptes auratus*	0	2	No
unidentified dove		0	1	No
unidentified grebe		0	1	No

Species	Scientific Name	Injuries	Fatalities	Songbird?
western grebe	*Aechmophorus occidentalis*	0	1	No
eared grebe	*Podiceps nigricollis*	0	1	No
unidentified finch		0	1	Yes
unidentified swallow		0	1	Yes
cedar waxwing	*Bombycilla cedrorum*	0	1	Yes
dark-eyed junco	*Junco hyemalis*	0	1	Yes
loggerhead shrike	*Lanius ludovicianus*	0	1	Yes
Lincoln's sparrow	*Melospiza lincolnii*	0	1	Yes
northern mockingbird	*Mimus polyglottos*	0	1	Yes
sage thrasher	*Oreoscoptes montanus*	0	1	Yes
house sparrow	*Passer domesticus*	0	1	Yes
vesper sparrow	*Pooecetes gramineus*	0	1	Yes
unidentified kinglet	*Regulus spp*	0	1	Yes
unidentified hummingbird		0	1	No
great horned owl	*Bubo virginianus*	1	0	No
Total		2	108	NA*

*NA – Not Applicable

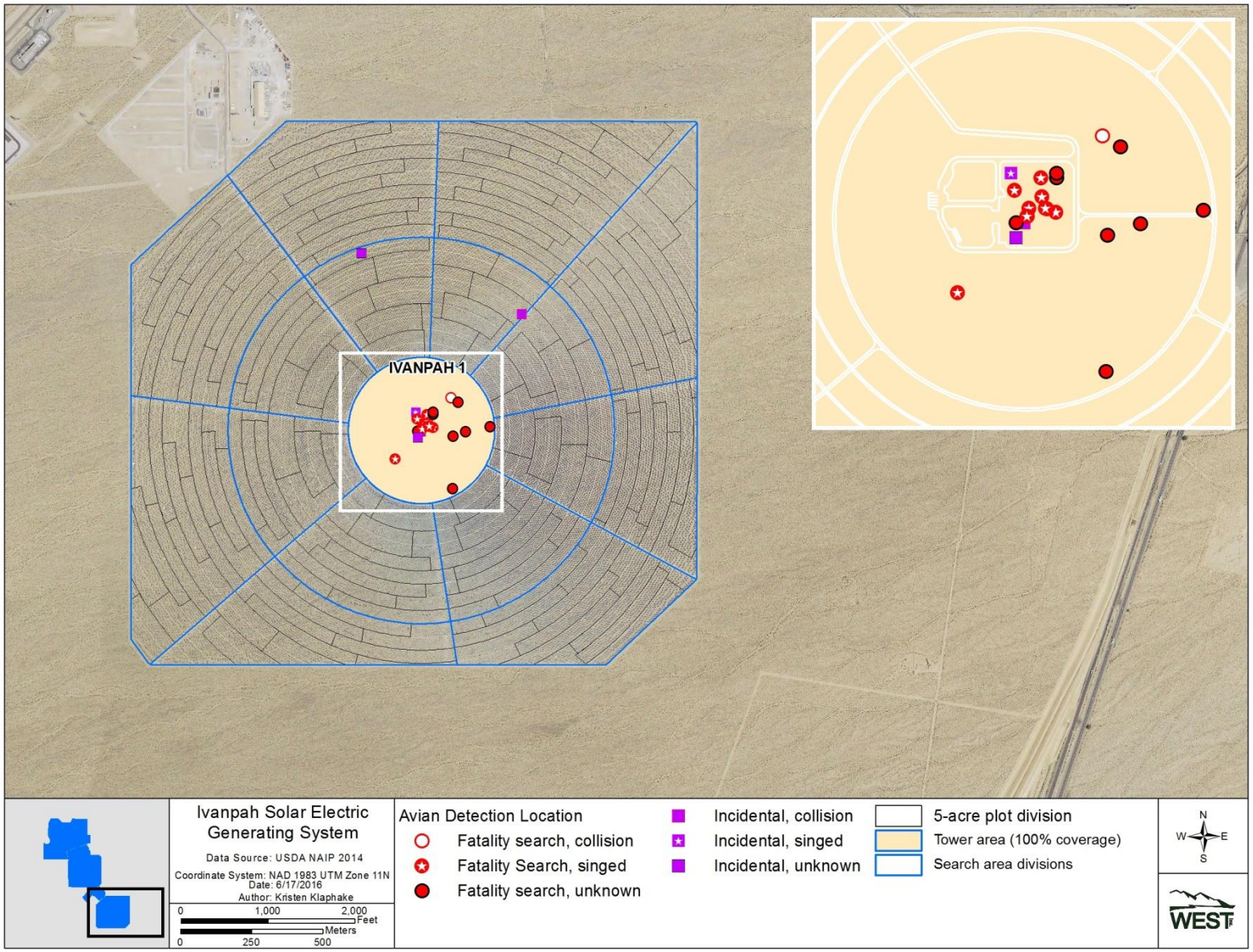

Figure 4. Ivanpah 1 Detections.

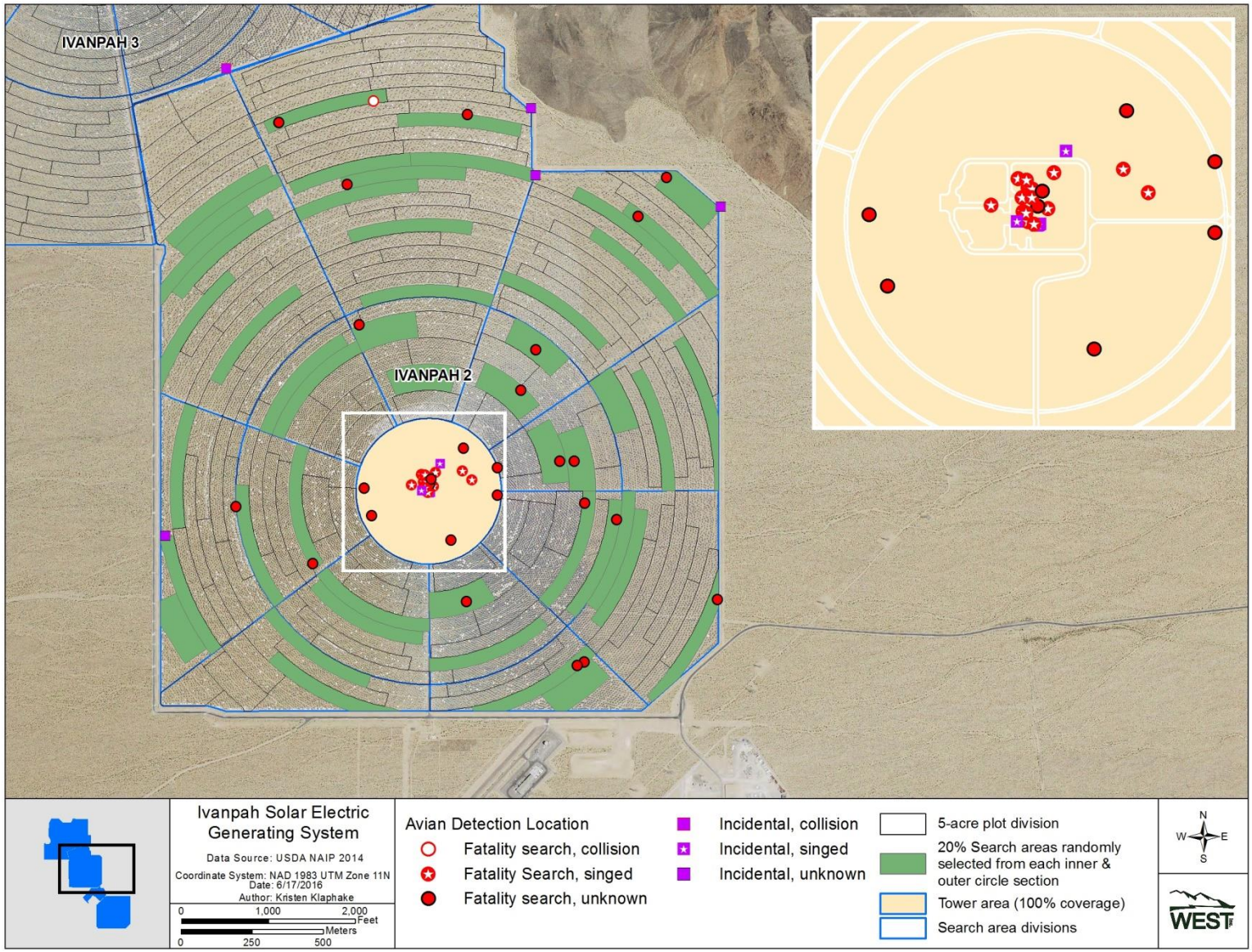

Figure 5. Ivanpah 2 Detections.

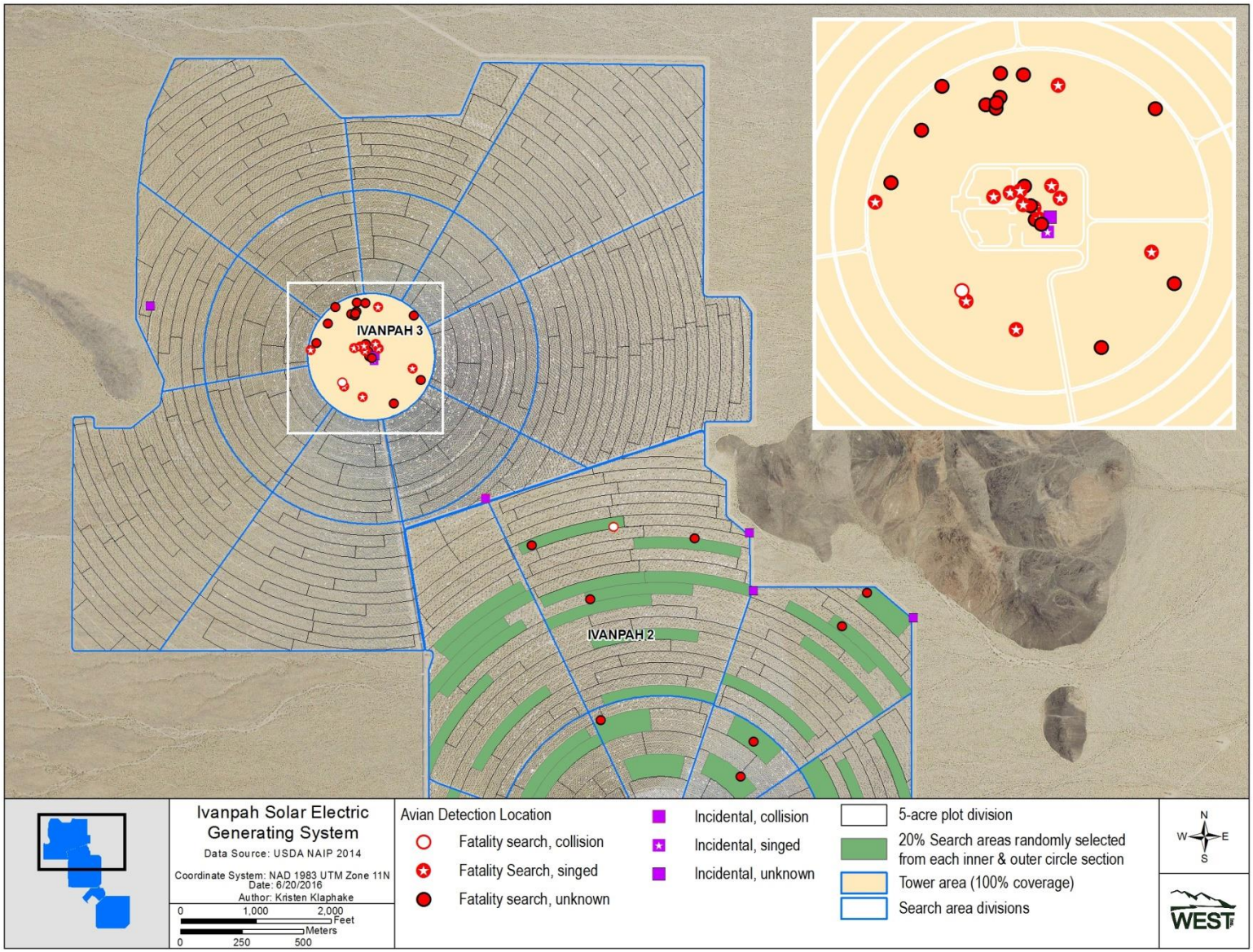

Figure 6. Ivanpah 3 Detections.

3.1.1 Temporal Patterns of Avian Detections

The number of detections reported per day was low in throughout the 2015 – 2016 winter season with one peak in early November. BirdCast reported scattered light movements of migrants in the Desert Southwest though early November. Early season flights of migrants were light in the Desert Southwest in early March increasing to moderate from mid to late March. Thus, the two peaks in late March are coincident with the onset of the spring migration season.

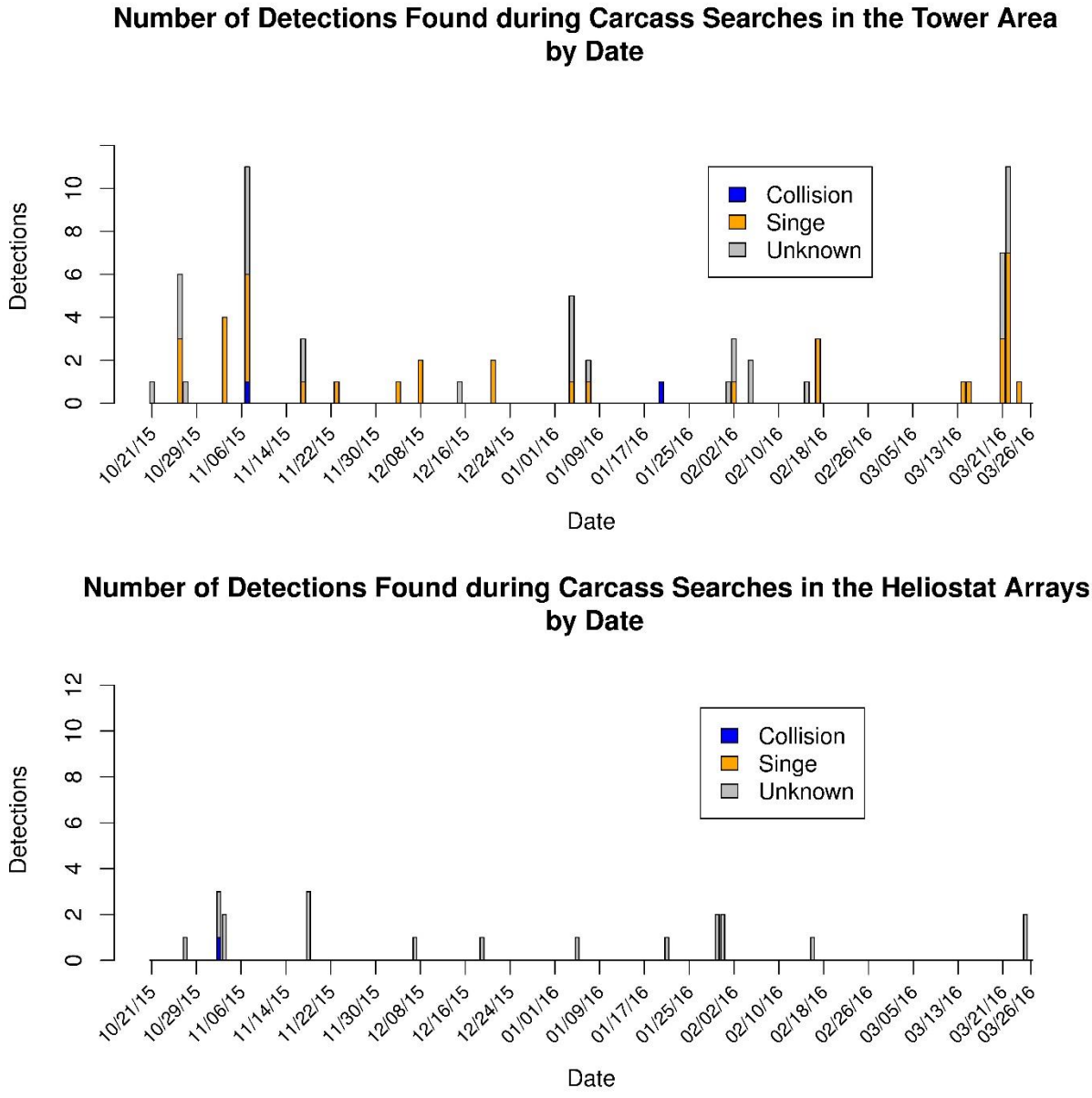

Figure 7. Number of Detections on Each Survey Date, 21 October 2015 – 25 March.

Two injured birds were detected during the 2015 – 2016 winter season (Table 3). A western meadowlark was discovered with evidence of collision. The bird was taken to Animal Kingdom Veterinary Hospital; it was released in good health on 5 November 2015. A great horned owl was discovered near the Unit 2 fenceline, apparently disoriented, but alert. The bird was captured and released outside of the facility in appropriate and safe habitat. All of these birds are included in this report as detections.

Table 3. Avian Injuries Detected 21 October 2015 – 25 March.

Date	Species	Age	Sex	Cause of Injury	Flux Grade	Fate
11/2/2015	western meadowlark	Adult	Unknown	Collision	NA	Released by Vet
1/26/2016	great horned owl	Unknown	Unknown	Unknown	NA	Released off-site

3.1.3 Summary of Bat Detections

Three bats representing two species and one unidentified species were detected during the 2015 – 2016 winter season. A Mexican free-tailed bat was located near the Unit 1 tower, an unidentified bat was located in the Unit 2 ACC, and a canyon bat was located in the Unit 3 ACC. Given the few detections of bats, they are not discussed further.

3.2 Locations of Avian Detections

3.2.1 Detections by Project Area

During winter 2015 – 2016, of the 110 total detections, 83 detections (75.5%) were recorded at the tower area, 25 detections (22.7%) were recorded over the heliostat area, 2 (1.8%) of the detections were located at other project lands (Table 4). Of the 110 avian detections, 24 (21.8%) were detected in Unit 1, 52 (47.3%) in Unit 2, and 34 (30.9%) in Unit 3.

Table 4. Locations of Avian Detections, 21 October 2015 – 25 March 2016.

Location	Carcasses	Injuries	Percent of Total
Tower Area	83	0	75.5%
Heliostat Array	24	1	22.7%
Other Project Lands[1]	1	1	1.8%
Total	108	2	100.0%

[1] Detections were at fenceline from surveys conducted per Revision 12, which were discontinued after November 16, 2015.

3.3 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 8 shows the distribution of detections by cause.

3.3.1 Singeing Effects

Of the 110 avian detections during the 2015 – 2016 winter season, 46 detections (41.8%) showed signs of singed feather damage, and 100% of singed detections were recorded in the tower area (Table 5).

3.3.2 Collisions

Of the 110 avian detections, evidence of collision was observed in the case of 6 (5.5%). Two detections with evidence of collision were located in the tower area; the remaining 4 detections were 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).

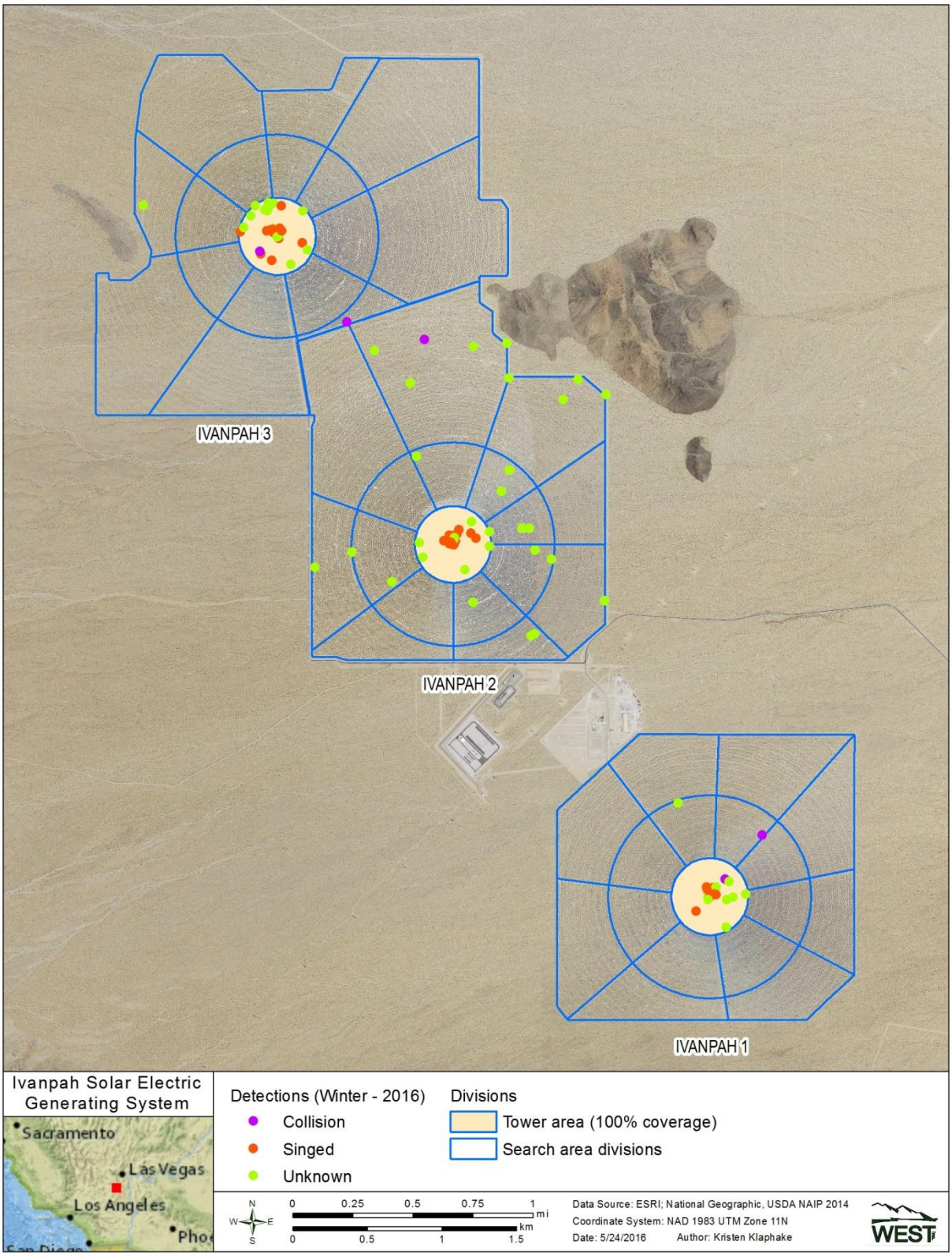

Figure 8. Locations of Singed and Unsinged Detections within Solar Units.

3.3.4 Detections of Unknown Cause

Of the 110 avian detections, evidence of singeing, collision, or other cause could not be assigned for 58 detections (52.7%; Table 5). Per the Plan section 2.1, these detections cannot be presumed with 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, 22 (37.9%) were recorded in the heliostat area; 34 (58.6%) were recorded in the tower area, and the remaining 2 (3.5%) were found at other facility locations (fenceline). These detections showed no evidence of collision effects, and microscopic analysis did not indicate signs of singeing. Of these unknown detections, 41 (70.7%) were feather spots, 12 (20.7%) were broken-up carcasses that had been scavenged, and only 5 (8.6%) were of a whole carcass or live, injured bird.

Table 5. Locations of Bird Detections, 21 October 2015 – 25 March 2016.

Location	Singeing	Collision	Unknown	Total
Tower Area	46	3	34	83
Heliostat Area	0	3	22	25
Other Project Lands[1]	0	0	2	2
Total	46	6	58	110

[1] Detections were at fenceline from surveys conducted per Revision 12, which were discontinued after November 16, 2015.

3.4 Types of Detections

Sixty-seven (44.1%) of the 110 detections consisted only of feather spots (Table 6a). Feather spots accounted for over 92% of detections in the heliostats area, and 51.8% of detection in the tower area. Percent of the detections that were feather spots was lower in the power block (40.8%), and no detections in the ACC were feather spots. Evidence of singeing was noted through direct and microscopic examination on 16 of these 67 feather spots; evidence of collision (i.e., an impact imprint on a nearby mirror) was noted in the case of two feather spots. Otherwise, the causes of the feather spots for the other 49 detections are unknown (Table 6b).

Table 6a. Percent Composition Feather Spots to Carcasses Relative to Site Locations.

Location	Carcasses	Feather Spot	Total	Percent Feather Spot*
Tower Area	40	43	83	51.8%
Heliostat Area	2	23	25	92%
Other Project Lands**	1	1	2	50%
Total	43	67	110	60.9%

*NA = Not applicable

**Detections were at fenceline from surveys conducted per Revision 12, which were discontinued after November 16, 2015.

Table 6b. Percent Composition Feather Spots to Carcasses Relative to Cause.

Cause	Carcasses	Feather Spots	Total Detections	Percent Feather Spot*
Collision	4	2	6	33.3%
Singed	30	16	46	34.8%
Unknown	9	49	58	84.5%
Total	43	67	110	60.9%

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

Section 4.0 Fatality Estimation

This section utilizes the detection data as described in Section 3 to develop an overall fatality estimate in accordance with the Plan (2015). 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, and heliostat area.

4.1 Estimating Model Parameters

4.1.1 Carcass persistence Trials

A total of 30 small bird carcass persistence trials were conducted during the 2015 – 2016 winter monitoring season. Trials were distributed throughout the facility. Consistent with previous seasons, scavengers included common ravens (*Corvus corax*, N=11), desert kit fox (*Vulpes macrotis*; N=6), white-tailed antelope squirrels (*Ammospermophilus leucurus*; N=4), greater roadrunner (*Geococcyx californianus*; N=3), and loggerhead shrike (*Lanius ludovicianus*; N=1). In one instance no scavenger was captured on film. Small bird carcass persistence ranged from less than one day in the case of 12 carcasses to 32.5 days; no carcasses lasted the full six week trial period (Figure 9). Large bird carcass persistence trials were discontinued beginning fall 2015 per TAC approval because no seasonal effects were found in previous large bird models and most trial carcasses persisted at least 42 days (Figure 10).

In addition to the 2015 – 2016 winter trials described above, carcass persistence trials from the first two years of monitoring were also used in the model. Carcass persistence data from 127 carcass persistence trials conducted during the 2014 - 2015 monitoring year (97 small birds and 30 large birds distributed throughout the facility) and data from 87 trials (57 small birds and 30 large birds distributed throughout the facility) performed during the first year of monitoring (29 October 2013 – 20 October 2014) were used to model carcass persistence time. Details on carcass persistence times can be found in each respective seasonal report.

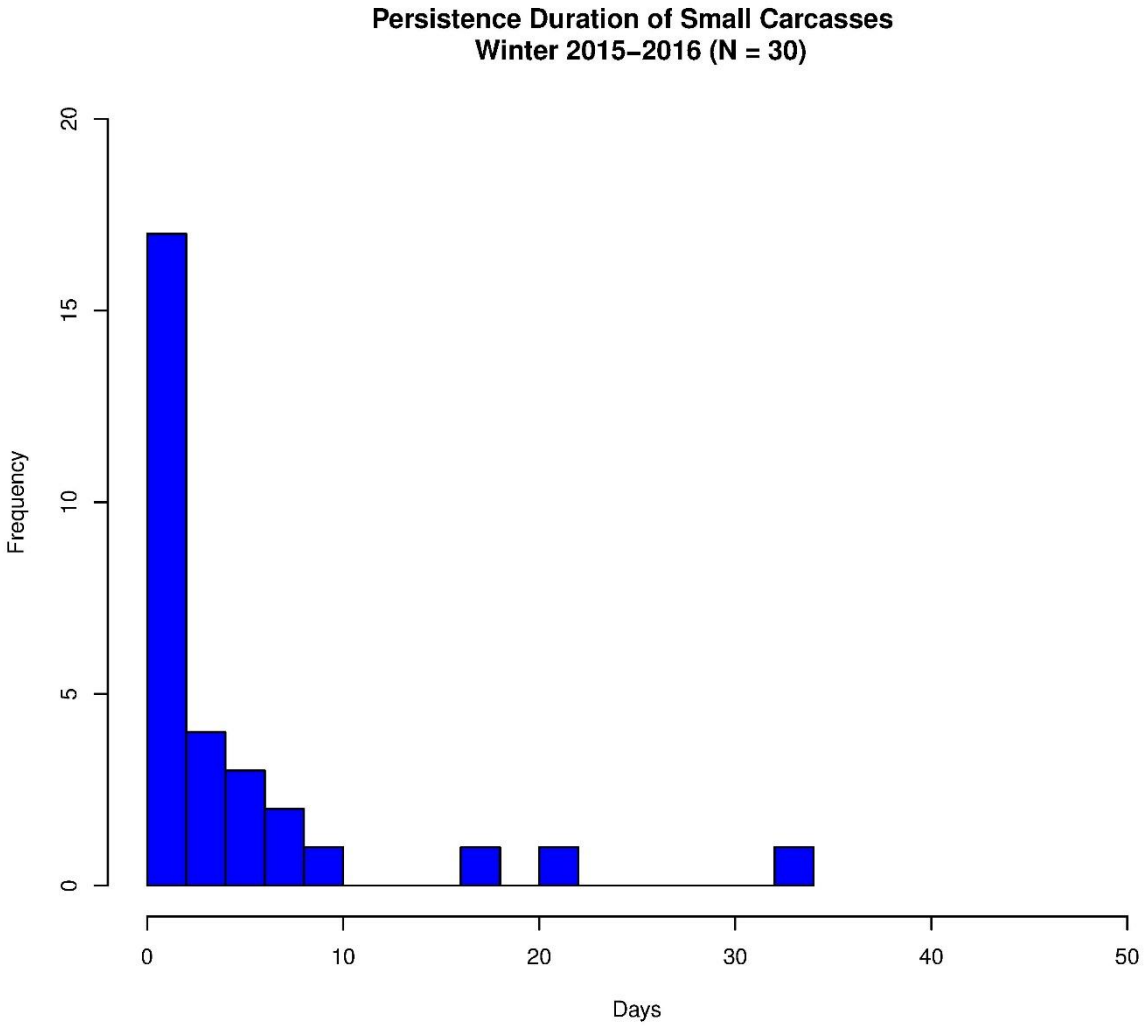

Figure 9. Persistence Durations for Small Carcasses Placed for 2015-2016 Winter Carcass Persistence Trials (N = 30).

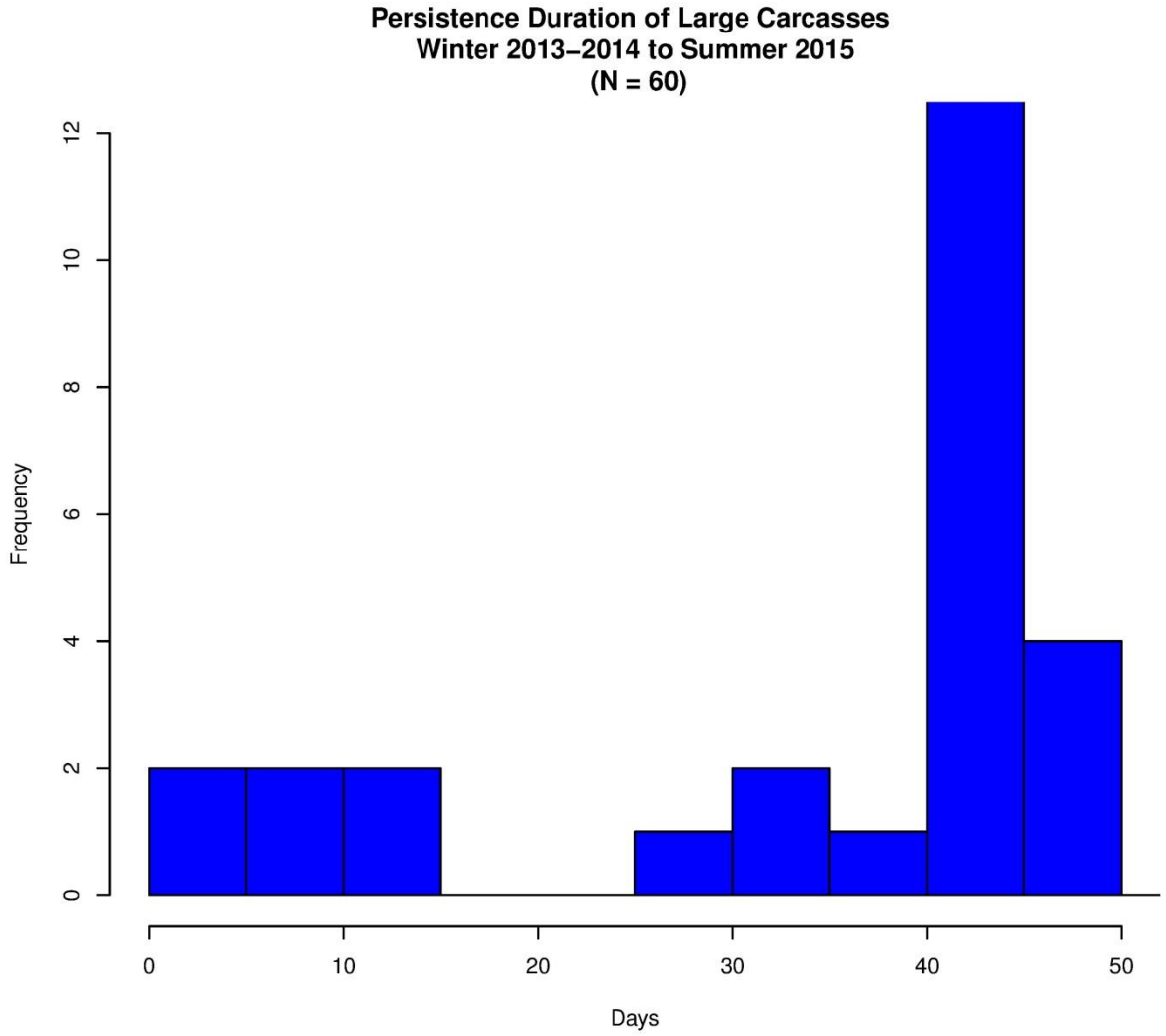

Figure 10. Persistence Durations for Large Carcasses Placed for All Carcass Persistence Trials.

4.1.2 Model Selection for Carcass Persistence Distribution

Consistent with the second year of monitoring and the findings that the removal process for small birds and large birds has been markedly different, two separate carcass persistence models were fit to this dataset: one for small birds and one for large birds. Specifically, large birds consistently persist for long periods of time (typically greater than six weeks), while 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.

Based on the carcass persistence data from the cumulative trials, 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 fall with 2015 fall persistence trial results). At the conclusion of the first year of monitoring, the location of a carcass (unvegetated tower area or the vegetated heliostat area, fenceline, or collector line) was not present in the top models for carcass persistence. Thus, carcass location was not included as a covariate for this report.

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 had ΔAICc values ≤ 2; for large birds, the exponential, Weibull, loglogistic, and lognormal models with intercept only had ΔAICc values ≤ 2 (Tables 7a and 7b). Ultimately, a loglogistic model with season covariate was chosen for small birds, and an exponential 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 for each season, with seasons pooled across years. 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 96.5% of large carcasses persisted for the nominal search interval (21 days), and 30.1% of small bird carcasses persisted for the nominal search interval of during the 2015 – 2016 winter monitoring season.

Table 7a. AICc Values for Small Bird Carcass Persistence Models

Small Bird Trials			
Covariates	Distribution	AICc	Δ AICc
Season	loglogistic	963.26	0
Season	lognormal	963.59	0.33
Year + Season	loglogistic	964.44	1.18
Year + Season	lognormal	964.61	1.35
Intercept	lognormal	968.21	4.95
Year + Season	weibull	968.34	5.08
Season	weibull	968.47	5.21
Intercept	loglogistic	968.6	5.34
Year + Season + Year*Season	loglogistic	973.33	10.07
Year + Season + Year*Season	lognormal	974.29	11.03
Year + Season + Year*Season	weibull	977.13	13.87
Intercept	weibull	978.69	15.43
Year + Season	exponential	1068.38	105.12
Year + Season + Year*Season	exponential	1073.49	110.23
Season	exponential	1074.8	111.54
Intercept	exponential	1104.83	141.57

Table 7b. AICc Values for Large Bird Carcass Persistence Models

Large Bird Trials			
Covariates	Distribution	AICc	Δ AICc
Intercept	exponential	97.00	0
Intercept	weibull	97.96	0.96
Intercept	loglogistic	98.03	1.03
Intercept	lognormal	98.15	1.15
Season	exponential	98.34	1.34
Season	weibull	99.62	2.62
Year + Season	exponential	99.64	2.64
Season	loglogistic	99.75	2.75
Season	lognormal	99.87	2.87
Year + Season	lognormal	100.68	3.68
Year + Season	loglogistic	100.98	3.98
Year + Season	weibull	101.08	4.08
Year + Season + Year*Season	exponential	107.36	10.36
Year + Season + Year*Season	lognormal	108.69	11.69
Year + Season + Year*Season	loglogistic	109.00	12.00
Year + Season + Year*Season	weibull	109.09	12.09

4.1.3 Searcher Efficiency Trials

During the 2015 – 2016 winter season, a total of 83 searcher efficiency trials (33 small birds, 24 large birds, and 26 feather spots) were placed. Trials were placed in locations with various vegetation heights and with a range of contrast between the soil and vegetation to represent the various conditions under which searches occur. Carcasses were placed in most areas where searches occurred (tower area and heliostat area). Fourteen trials (9 small birds, 2 large birds, and 3 feather spots) were removed (scavenged) prior to a searcher having the opportunity to detect the carcass.

A total of 320 human searcher efficiency trials (129 small birds, 96 large birds, and 95 feather spots) from the 2014 - 2015 monitoring year used to fit a searcher efficiency model for the 2015 – 2016 winter season. Of the 320 trial carcasses placed, 268 (129 small carcasses, 96 large carcasses, and 95 feather spots) were available to be found; 52 carcasses (42 small carcasses, 8 large carcass, and 2 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 also 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.

Human searcher efficiency rates were generally higher on in the unvegetated areas in the tower area. During the 2015 – 2016 winter season, in unvegetated areas, human searcher efficiency was 79% for

small birds, 92% for large birds, and 79% for feather spots. In the vegetated areas in the heliostat arrays, human searcher efficiency was 52% for small birds, 76% for large birds, and 51% for feather spots.

Table 8. Covariates, AICc Values, and ΔAICc values for the top ten searcher efficiency models. Data consist of all human searcher efficiency trials for carcasses from the initiation of trials through March 25, 2016.

Covariates	AICc	Δ AICc
Size + Project Area + Season + Year	586.57	0
Size + Project Area	589.86	3.29
Season + Size*Project Area + Year	590.13	3.56
Size + Season + Size*Project Area + Year	590.13	3.56
Project Area + Season + Size*Project Area + Year	590.13	3.56
Size + Project Area + Season + Size*Project Area + Year	590.13	3.56
Size + Project Area + Year	590.27	3.71
Project Area + Season + Size*Year	590.59	4.02
Size + Project Area + Season + Size*Year	590.59	4.02
Project Area + Season + Year + Size*Year	590.59	4.02

The best model for searcher efficiency included carcass size, project area, season, and year with an AICc value 3.29 points lower than the second best model that included size and project area (Table 8). Thus, the most supported searcher efficiency model produces searcher efficiency estimates based on carcass size, project area (unvegetated tower area and vegetated heliostat area), season, and year. Searcher efficiency values used to adjust detections to calculate a fatality estimate are provided in Table 9 and are based on all searcher efficiency data collected.

Table 9. Human Searcher Efficiency Sample Sizes Used for Modeling, and Model Predictions for Size and Project Area Categories Winter 1 – Winter 3.

Size	Location	Found	Available	Placed	Predicted Searcher Efficiency (90% CI)
Feather spot	Tower area (Unvegetated)	59	83	87	0.79 (0.68-0.87)
Large bird	Tower area (Unvegetated)	62	73	80	0.92 (0.87-0.96)
Small bird	Tower area (Unvegetated)	57	80	111	0.79 (0.70-0.87)
Feather spot	Heliostat area (Vegetated)	36	90	91	0.76 (0.38-0.66)
Large bird	Heliostat area (Vegetated)	50	76	84	0.52 (0.65-0.87)
Small bird	Heliostat area (Vegetated)	30	79	104	0.51 (0.39-0.66)

4.2 Fatality Estimates of Known Causes for 2015 – 2016 Winter Monitoring

Fatality estimates were calculated separately for the tower area (power block and inner HD heliostats) and heliostat area. 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).

4.3.1 Total Fatality Estimates for Known Causes

There were 52 bird detections where the cause of death or injury could be determined and were facility related, of which 42 were included in the fatality estimate model (Tables 10a and 10b); of these 42 detections, 11 were from the ACC that were added unadjusted to the estimator output, to produce the total fatality estimate of known cause (Tables 11 and 12). There were 9 detections showing evidence of singeing or collision outside the ACC buildings that were not included in the fatality estimates; one was excluded because it was outside the standardized survey area and 8 were excluded because they were determined to be older than the search interval.

Table 10a. 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	Collision	Flux	Other	Total
Tower Area	3	37	0	0	9	0	49
Heliostat Area	1	0	0	2	0	0	3
Total	4	37	0	2	9	0	52

Table 10b. 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	3	37	2	0	9	0	48
Heliostat Area	0	1	0	1	1	0	3
Total	3	38	2	1	10	0	52

* All raptors are considered "Large Birds", therefore the number of raptor detections in a row or column is not added to the total.

Table 11. 2015 – 2016 Winter Season Avian Fatality Estimates by Cause and Project Element (with Lower and Upper 90% Confidence Intervals) Based on Detections of Known Causes Included in the Model.

Location	Collision	Singed	Total Known Cause
Tower Area	N ≤ 5	104 (88-129)	113 (95-139)
Heliostat Area	N ≤ 5	0	N ≤ 5
Total	N ≤ 5	104 (88-129)	133 (101-187)

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

Table 12. 2015 – 2016 Winter Season Avian Fatality Estimates by Carcass Size and Project Element (with Lower and Upper 90% Confidence Intervals) Based on Detections of Known Causes Included in the Model.

Location	Large Birds	Small Birds	Raptors	Total
Tower Area	N ≤ 5	110 (92-136)	N ≤ 5	113 (95-139)
Heliostat Area	N ≤ 5	N ≤ 5	0	N ≤ 5
Total	N ≤ 5	130 (98-184)	N ≤ 5	133 (101-187)

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

4.3.2 Fatality Estimate for Tower Area and Heliostat Area

Tables 11 and 12 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.

During the period 21 October 2015 – 25 March 2016 (229 days of monitoring), there were an estimated 133 fatalities (90% confidence interval 101-187) based on detections from known causes (i.e., singeing, collision; Table 11). Of these, 113 fatalities (79.5%) were estimated for the 154 acre tower area; 5 or fewer collision detections and 5 or fewer detections were located in the heliostat area. Thus, no estimate is provided. There were 130 estimated small bird fatalities (Table 12).

4.4 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 58 detections where the cause of death could not be determined, of which 48 were included in the fatality estimator (Tables 13a and 13b). Of the 11 detections of unknown cause excluded from the fatality estimator, 7 detections were determined to be older than the search interval. Of the remaining four excluded detections, two were discovered at the unit fence and two were discovered in the heliostat areas of units 1 and 3, which are not part of the standard search area required under the Plan (2015).

Table 13a Number of Detections from Unknown Causes in Each Project Element, and Number Included in Fatality Estimates, by Cause.

Location	Included	Excluded	Total
Tower Area	30	4	34
Heliostat Area	17	5	22
Other Project Lands	0	2	2
Total	48	11	58

Table 13b. 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	3	27	0	0	4	0	34
Heliostat Area	1	16	0	1	4	0	22
Other Project Lands	0	0	0	2	0	0	2
Total	4	43	0	3	8	0	58

* All raptors are considered "Large Birds", therefore the number of raptor detections in a row or column is not added to the total.

4.4.1 Total Fatality Estimates from Unknown Causes

During the period of 21 October 2015 – 25 March 2016, the total estimate of fatalities from unknown cause was 1185 (90% confidence interval 694-1185; Table 14). A total of 108 (90% confidence interval 89-137) were in the tower area, and 1077 (90% confidence interval estimates 594-1761) in the heliostat area). Of the estimated unknown cause fatalities, small birds accounted for 98% of the estimated fatalities (Table 15).

Table 14. Site-Wide Fatality Estimates from Unknown Causes by Location, 21 October 2015 – 25 March.

Project Area	Estimate (90% CI)
Tower Area	108 (89-137)
Heliostat Area	1077 (594-1761)
Total	1185 (694-1885)

Table 15. Site-Wide Fatality Estimates from Unknown Causes by Size and Location, 21 October 2015 – 25 March.

Location	Large Birds	Small Birds	Raptors	Total
Tower Area	N ≤ 5	104 (86-133)	0	108 (89-137)
Heliostat Area	N ≤ 5	1052(570-1724)	0	1077 (594-1761)
Total	N ≤ 5	1156 (667-1841)	0	1185 (694-1885)

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

4.6 Regional Awareness Monitoring

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

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

Joanne Stefanatos representing Animal Kingdom Veterinary Hospital; Ryan Regnell representing the BLM; Craig Himmelwright, D.V.M. in Ivanpah Valley representing the Designated Biologists for the Project; and Magdalena Rodriquez from CDFW were contacted on 21 November 2015. The contact date occurred when the number of detections reported per day had begun to decline. Each reported that they were not aware of any increase in avian fatalities for the region or any birds, injured or dead, which had been found with singed or scorched feathers since monitoring according to the Plan began at Ivanpah in early winter 2013-2015.

Section 5.0 Discussion

The 2015 – 2016 winter season represented the continuation of standardized monitoring of avian and bat detections and avian use of the Ivanpah site as revised per the Avian & Bat Monitoring and Management Plan (2015).

5.1 Temporal Patterns in Detections

The number of detections reported at the tower area was low throughout the 2015 – 2016 winter season with two peaks in November and two towards the onset of spring migration in March. Scattered light migration movements in the Desert Southwest were reported by the BirdCast analysis through 20 November 2015. BirdCast did not report migration analysis after 20 November 2015 suggesting fall migration had ended in the West region by this date. Thus, it can be assumed that some migrant birds were passing through the Project area through early to mid-November. BirdCast reported light to moderate flights of migrants from early March through late March, which aligns with the peak in detections per day in late March. The 21-day search interval results in an accumulation of carcasses at the tower area, and peaks in detections are associated with tower searches. Thus, a tower area search during the 2015 – 2016 winter season is a look back over approximately 21 days, so lag effects in detections per day compared to migrant songbird activity is expected. In other words, it would be expected that singed detections of migrant birds would be found after migration has slowed or started regionally due to the search schedule of the tower area.

5.2 Spatial Patterns Detections and Fatality Estimates

The distribution of known cause detections varied by facility area. Of collision detections, 50% were located in the heliostat area consistent with the risk of the heliostats to birds. Of singed detections, 100% occurred in the tower area indicating that singed birds rarely transition outside of the tower area.

Unknown cause detections accounted for approximately 53% of all detections during the 2015 – 2016 winter season, and the distribution of the unknown cause detections varied by facility type with 41% occurring outside of the tower area, suggesting unknown cause detections were not associated with singed birds as feather spots were closely examined for sings of singeing. Of the unknown cause detections, 84.5% were feather spots or partial carcasses that showed signs of scavenging. Determining a cause of mortality from a feather spot or partial carcass 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 6.0 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 – 2016 winter 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 73% of the detections were songbirds, and in general songbirds 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 songbird species is expected to have negligible effects on population dynamics.

None of the 11 species represented by more than three detections is particularly rare locally, regionally, or nationally. Rather, all 11 species are relatively abundant and widespread. Thus, the magnitude of detections of these species at Ivanpah during the 2015 fall season does not rise above the "low" category. Special-status species recorded as detections were two yellow warblers (California species of special concern) and one loggerhead shrike (California species of special concern). Loggerhead shrikes breed in the vicinity of the Project, whereas yellow warbler is a transient that breeds elsewhere.

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 two yellow warblers detected represented a very small proportion of these populations; thus, the estimated yellow warbler fatalities during the 2015 – 2016 winter season 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).

The loggerhead shrike is common in desert habitats of California, despite its declines in other regions. The southeastern deserts represent one of the areas of highest abundance in the state (Humple 2008),

and Breeding Bird Survey data indicate no significant declining population trends, or perhaps even a slight increase, in the Mojave Desert since the mid-1960s (Sauer et al. 2015). The North American population of this species is estimated at 2,900,000 birds (http://birds.audubon.org/species/logshr). The single detection recorded on the site indicates a low number of impacted individuals that would not substantially affect local, regional, or national populations of the species; thus the 2015 – 2016 winter season estimated fatalities do not rise above the "low" category.

Section 7.0 Literature Cited

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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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2016_001_ISEGS	Western Grebe	WEGR	Carcass Survey	1/4/2016	1/4/2016	Feather spot	3-6 days	Feather spot size large, consisting of 8 secondaries, 1 primary, 100 body feathers. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637677, 3937816	NA
2016_002_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	1/4/2016	1/4/2016	Feather spot	3-6 days	Feather spot size large, consisting of 5 rectrices, 9 primaries, 3 secondaries, 300 body feathers. Evidence of singe on several body feathers.	Scorched or singed	3	3	Heliostat	637644, 3937863	NA
2016_003_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	1/4/2016	1/4/2016	Feather spot	3-6 days	Feather spot size small, consisting of 9 rectrices, 9 primaries, 11 secondaries, 100+ body feathers. No evidence of collision or singe.	Unknown	NA	3	Heliostat	637410, 3938079	NA
2016_004_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	1/4/2016	1/4/2016	Feather spot	2 weeks	Feather spot size small, consisting of 2 rectrices, 9 primaries, 3 secondaries, 25 body feathers. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637411, 3938087	NA
2016_005_ISEGS	Cactus Wren	CACW	Carcass Survey	1/4/2016	1/4/2016	Feather spot	2 weeks	Feather spot size small, consisting of 4 rectrices, 1 primary, 1 secondary. No evidence of collision or singe.	Unknown	NA	3	Heliostat	637416, 3938095	NA
2016_006_ISEGS	Cactus Wren	CACW	Carcass Survey	1/5/2016	1/5/2016	Feather spot	8-24 hours	Feather spot size small, consisting of 12 rectrices, 6 primaries, 16 secondaries, 250+ body feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	638788, 3935459	NA
2016_007_ISEGS	Ruby-crowned Kinglet	RCKI	Carcass Survey	1/7/2016	1/7/2016	Mummified	1 month +	Whole carcass. Evidence of curling to all remaining flight feathers, singeing to face, chest, and back.	Scorched or singed	2/3	2	ACC Building	638630, 3935907	NA
2016_030_ISEGS	Costa's Hummingbird	COHU	Incidental	3/10/2016	3/10/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Carcass. Singe on right side of face, back and rump.	Scorched or singed	3	1	Powerblock	640354, 3933553	NA
2016_031_ISEGS	House Finch	HOFI	Carcass Survey	3/14/2016	3/14/2016	Dead, fresh (eyes moist)	8-24 hours	Whole carcass. Curling present on both wings, rectrices, and rump; singed on upper breast, top of head, and axillaries.	Scorched or singed	2/3	2	ACC Building	638644, 3935895	NA
2016_034_ISEGS	Anna's Hummingbird	ANHU	Carcass Survey	3/15/2016	3/15/2016	Mummified	2 weeks	Whole carcass. Curling present in both wings and tail; singeing to sides of face, throat, breast, flanks, and rump.	Scorched or singed	2/3	1	ACC Building	640395, 3933547	NA
2016_035_ISEGS	Tree Swallow	TRES	Incidental	3/18/2016	3/18/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. Curling present on primaries, secondaries, and tail; singeing to head, nape, and back.	Scorched or singed	2/3	2	Powerblock	638695, 3935944	NA
2016_021_ISEGS	Black-Throated Sparrow	BTSP	Carcass Survey	2/5/2016	2/5/2016	Dead, semi-fresh (eyes desiccated, rigor mortis)	NA	Whole carcass, not able to be retrieved during survey due to location.	NA	NA	1	ACC Building	640416, 3933547	NA
2016_022_ISEGS	Unknown Grebe	UNGR	Carcass Survey	2/5/2016	2/5/2016	Feather spot	2 weeks	Feather spot size small, consisting of 100 body feathers. No evidence of singe or collision.	Unknown	NA	1	Powerblock	640361, 3933486	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2016_023_ISEGS	Greater Roadrunner	GRRO	Incidental	2/14/2016	2/14/2016	Feather spot	2 weeks	Feather spot size large, consisting of 2 rectrices, 5 primaries, 1 secondary, and 9 body feathers. No evidence of singe or collision.	Unknown	NA	2	Fence	639014, 3937194	NA
2016_024_ISEGS	Northern Flicker	NOFL	Carcass Survey	2/15/2016	2/15/2016	Feather spot	3-6 days	Feather spot size small consisting of 150 body feathers. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637253, 3937967	NA
2016_025_ISEGS	Anna's Hummingbird	ANHU	Incidental	2/15/2016	2/15/2016	Dead, fresh (eyes moist)	0-8 hours	Whole carcass. Evidence of curling on flight feathers of right wing and rectrices, singeing to nape, back, and rump.	Scorched or singed	1/3	3	Powerblock	637488, 3937893	NA
2016_026_ISEGS	Western Meadowlark	WEME	Carcass Survey	2/16/2016	2/16/2016	Broken up	3-6 days	Broken up carcass consisting of partial left wing. No evidence of singe or collision.	Unknown	NA	2	Heliostat	639031, 3936344	NA
2016_013_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	1/30/2016	1/30/2016	Feather spot	2 weeks	Feather spot size small, consisting of 5 primaries, 1 secondary, and 30 body feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	638246, 3935594	NA
2016_014_ISEGS	Unknown Small Bird	UNID	Carcass Survey	1/30/2016	1/30/2016	Feather spot	3-6 days	Feather spot size small, consisting 1 primary, 50 body feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	637977, 3935794	NA
2016_015_ISEGS	Unknown Small Bird	UNID	Carcass Survey	1/31/2016	1/31/2016	Feather spot	3-6 days	Feather spot size small, consisting of 3 rectrices, 3 primaries, 2 secondaries, 2 body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	639670, 3935467	NA
2016_016_ISEGS	Cactus Wren	CACW	Carcass Survey	1/31/2016	1/31/2016	Feather spot	3-6 days	Feather spot size large, consisting of 5 primaries, 2 rectrices, and 200+ body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	639177, 3935235	NA
2016_017_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	2/1/2016	2/1/2016	Broken up	3-6 days	Broken up carcass consisting of lower half of torso including legs and tail. No evidence of singe or collision.	Unknown	NA	2	Powerblock	638663, 3935890	NA
2016_018_ISEGS	Unknown Small Bird	UNID	Carcass Survey	2/2/2016	2/2/2016	Broken up	3-6 days	Broken up carcass 2 primaries connected by tissue, 5 retricies and 4 body feathers. No evidence of singe or collision	Unknown	NA	2	Heliostat	638453, 3935761	NA
2016_019_ISEGS	Western Meadowlark	WEME	Carcass Survey	2/2/2016	2/2/2016	Feather spot	3-6 days	Feather Spot size large with 5 secondaries, 2 primaries, 2 retricies and 75+ body. No evidence of collision or singe.	Unknown	NA	2	Heliostat	638428, 3935858	NA
2016_020_ISEGS	Anna's Hummingbird	ANHU	Carcass Survey	2/2/2016	2/2/2016	Dead; fresh (eyes moist)	0-8 hours	Whole Carcass found. Evidence of singe on rump, nape and left side of breast and face. Three retricies singed.	Scorched or singed	2/3	2	Heliostat	638773, 3935920	NA
2016_027_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	2/17/2016	2/17/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. Curl/singe on all major flight feathers, singe on head, nape, throat, breast and axillaries.	Scorched or singed	2/3	2	Powerblock	638644, 3935849	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2016_028_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	2/17/2016	2/17/2016	Feather spot	3-6 days	Feather spot size = large. 5 primaries, 4 secondaries, 20+body feathers. Tips of body feathers with singe.	Scorched or singed	NA	2	Powerblock	638641, 3935860	NA
2016_029_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	2/17/2016	2/17/2016	Dead, fresh (eyes moist)	0-8 hours	Carcass. Singe on flank and rump.	Scorched or singed	3	2	Powerblock	638594, 3935871	NA
2016_036_ISEGS	Violet-green Swallow	VGSW	Carcass Survey	3/21/2016	3/21/2016	Broken up	3-6 days	Broken up carcass consisting of partial right and left wing connected by tissue, body feathers clumped and connected by skin. Evidence of curling to primaries and secondaries.	Scorched or singed	NA	3	Heliostat	637441, 3937747	NA
2016_037_ISEGS	Violet-green Swallow	VGSW	Carcass Survey	3/21/2016	3/21/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Curling to primaries, singeing present on head, back, and rump.	Scorched or singed	3	3	Heliostat	637366, 3937790	NA
2016_038_ISEGS	Horned Lark	HOLA	Carcass Survey	3/21/2016	3/21/2016	Feather spot	3-6 days	Feather spot size large, consisting of 5 rectrices. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637299, 3938046	NA
2016_039_ISEGS	Horned Lark	HOLA	Carcass Survey	3/21/2016	3/21/2016	Feather spot	3-6 days	Feather spot size small, consisting of 2 rectrices and 8 body feathers. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637395, 3938084	NA
2016_040_ISEGS	Unknown Swallow	UNSW	Carcass Survey	3/21/2016	3/21/2016	Broken up	3-6 days	Broken up carcass, consisting of partial left and right wing, pelvic region including both legs, and 50 body feathers. Evidence of singeing to tip of flight feathers and coverts.	Scorched or singed	Unk	3	Heliostat	637504, 3938113	NA
2016_041_ISEGS	Lincoln's Sparrow	LISP	Carcass Survey	3/21/2016	3/21/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	8-24 hours	Whole carcass. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637568, 3937720	NA
2016_042_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/21/2016	3/21/2016	Broken up	2 weeks	Broken up carcass consisting of 100 body feathers and part of top of skull contained in animal scat. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637329, 3938112	NA
2016_043_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass found. Curling to central rectrices; singeing to nape, back, and rump.	Scorched or singed	2/3	3	Powerblock	637451, 3937934	NA
2016_044_ISEGS	Costa's Hummingbird	COHU	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Evidence of curling to left wing and central rectrices; singeing to throat and right side of face, back, nape, and rump.	Scorched or singed	1/3	3	Powerblock	637432, 3937952	NA
2016_045_ISEGS	Tree Swallow	TRES	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Curling to primaries, secondaries, and tail; singeing to rump, back, breast, sides of face and top of head.	Scorched or singed	2/3	2	ACC Building	638636, 3935881	NA
2016_046_ISEGS	Tree Swallow	TRES	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Curling to all flight feathers in wings and tail, singeing to sides of face, left flank, and rump.	Scorched or singed	2/3	2	ACC Building	638650, 3935893	NA
2016_047_ISEGS	Tree Swallow	TRES	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Curling to primaries, secondaries, and coverts in wings, and in tail, singeing to face, head, nape, breast, back and rump.	Scorched or singed	2/3	2	ACC Building	638642, 3935905	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2016_048_ISEGS	Tree Swallow	TRES	Carcass Survey	3/22/2016	3/22/2016	Dead, Semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Evidence of curling to primaries, secondaries, and coverts on both wings and in tail, singeing to sides of face.	Scorched or singed	2/3	2	ACC Building	638679, 3935915	NA
2016_049_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/22/2016	3/22/2016	Broken up	3-6 days	Broken up carcass consisting of body feathers held together by sinew. No evidence of collision or singe.	Unknown	NA	2	Heliostat	638897, 3935930	NA
2016_050_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/22/2016	3/22/2016	Feather spot	1 month +	Feather spot size small, consisting of 6 primaries, 6 secondaries, and 2 rectrices. Evidence of singeing on tail feather.	Scorched or singed	Unk	3	Powerblock	637507, 3937944	NA
2016_051_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/22/2016	3/22/2016	Feather spot	3-6 days	Feather spot size small, consisting of 11 body feathers. No evidence of collision or singe (checked under microscope.)	Unknown	NA	3	Powerblock	637478, 3937905	NA
2016_052_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/22/2016	3/22/2016	Broken up	3-6 days	Broken up carcass consisting of 5 rectrices of which 2 were held together by sinew, 1 primary, 9 body feathers, 1 secondary. No evidence of collision of singe.	Unknown	NA	2	Heliostat	638897, 3935834	NA
2016_053_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	3/22/2016	3/22/2016	Feather spot	3-6 days	Broken up carcass consisting of 35 body feathers, 1 primary, 1 rectrice, 3 secondaries connected to coverts on left wing by tissue. No evidence of singe or collision.	Unknown	NA	2	Heliostat	638733, 3935676	NA
2016_054_ISEGS	Horned Lark	HOLA	Carcass Survey	3/24/2016	3/24/2016	Dead, fresh (eyes moist)	0-8 hours	Whole Carcass Flight feathers singed off. Singe covering 80% of body Grade 2 and 3	Scorched or singed	2/3	1	Powerblock	640379, 3933506	NA
2016_055_ISEGS	Loggerhead Shrike	LOSH	Carcass Survey	3/25/2016	3/25/2016	Feather spot	2 weeks	Feather spot small, consisting of 2 rectrices, 50 body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	638367, 3936925	NA
2016_056_ISEGS	Unknown Small Bird	UNID	Carcass Survey	3/25/2016	3/25/2016	Feather spot	3-6 days	Feather spot size large, consisting of 13 body feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	638791, 3937171	NA
2015_856_ISEGS	Unknown Small Bird	UNID	Carcass Survey	12/15/2015	12/15/2015	Feather spot	2 weeks	Feather spot size small consisting of 4 rectrices, 2 secondaries, 9 primaries, and 50 body feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	638777, 3935999	NA
2015_857_ISEGS	Cactus Wren	CACW	Carcass Survey	12/19/2015	12/19/2015	Feather spot	2 days	Feather size small consisting of 12 rectrices, 15 primaries, 3 secondaries, and 300 body feathers. No evidence of singeing or collision.	Unknown	NA	2	Heliostat	639201, 3935248	NA
2015_858_ISEGS	Dark-Eyed Junco	DEJU	Incidental	12/20/2015	12/20/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. No evidence of singeing or collision.	Unknown	NA	3	Powerblock	637492, 3937916	NA
2015_859_ISEGS	Unknown Small Bird	UNID	Carcass Survey	12/21/2015	12/21/2015	Feather spot	3-6 days	Feather Spot Size = Small. 35 body feathers, all with singe at tips.	Scorched or singed	Unk	1	Powerblock	640376, 3933495	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2015_860_ISEGS	Unknown Small Bird	UNID	Carcass Survey	12/21/2015	12/21/2015	Feather spot	2 weeks	Feather Spot Size = small. 1 retrice, 30+ body feathers. Singe on tips of body feathers and retrice.	Scorched or singed	Unk	1	Powerblock	640377, 3933495	NA
2016_008_ISEGS	Northern Mockingbird	NOMO	Carcass Survey	1/7/2016	1/7/2016	Feather spot	2 weeks	Feather spot size small, consisting of 6 rectrices, 1 alula, 10 primaries, 11 secondaries, 50+ body feathers. No evidence of singeing or collision.	Unknown	NA	2	Powerblock	638657, 3935870	NA
2016_009_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	1/20/2016	1/20/2016	Dead, semi-fresh (eyes desiccated, rigor mortis)	0-8 hours	Carcass. No visible trauma, but shows fresh blood and proximity to heliostat. No singe	Collision with solar panel/heliostat	NA	3	Heliostat	637359, 3937806	NA
2016_010_ISEGS	Yellow Warbler	YWAR	Incidental	1/20/2016	1/21/2016	Mummified	1 month +	Whole carcass found. Evidence of singeing to head, neck, back, rump, breast, and all major flight feathers.	Scorched or singed	2/3	2	Solar Concentrating Tower	638629, 3935849	NA
2016_011_ISEGS	Horned Lark	HOLA	Carcass Survey	1/21/2016	1/21/2016	Feather spot	1 month +	Feather spot size small, consisting of 7 rectrices, 11 secondaries, 10 primaries, 4 undertail coverts, 50 body feathers, and 6 broken feathers. No evidence of singe or collision.	Unknown	NA	2	Heliostat	639203, 3935806	NA
2016_012_ISEGS	Great Horned Owl	GHOW	Incidental	1/26/2016	1/26/2016	Alive, injured	0-8 hours	Alive. No visible trauma or external injuries. No singe. Disoriented but alert	Unknown	NA	2	Fence	639680, 3936848	NA
2015_805_ISEGS	Unknown Small Bird	UNID	Carcass Survey	10/21/2015	10/21/2015	Feather spot	3-6 days	Feather spot size small, consisting of 12 clumped body feathers. No evidence of singe or collision.	Unknown	NA	1	Heliostat	640485, 3933469	NA
2015_806_ISEGS	Unknown Small Bird	UNID	Incidental	10/21/2015	10/21/2015	Feather spot	2 days	Feather spot size = small. 22 body feathers. No singe	Unknown	NA	2	Heliostat	639030, 3936959	NA
2015_807_ISEGS	Barn Swallow	BARS	Incidental	10/21/2015	10/21/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole carcass. Evidence of singe on flight feathers in wing and tail, throughout body and in back.	Scorched or singed	2/3	2	Powerblock	638659, 3935845	NA
2015_808_ISEGS	White-Crowned Sparrow	WCSP	Incidental	10/22/2015	10/22/2015	Broken up	3-6 days	Broken up carcass, consisting of a partial right wing. No evidence of collision or singe.	Unknown	NA	2	Heliostat	637727, 3935692	NA
2015_809_ISEGS	Unknown Finch	UNFI	Carcass Survey	10/26/2015	10/26/2015	Feather spot	3-6 days	Feather spot size large, consisting of 200 body feathers, 3 rectrices, 7 secondaries, and 5 primaries. Evidence of curling to both flight and body feathers.	Scorched or singed	3	3	Powerblock	637468, 3937930	BLM corrected Scientific Name 29 Dec 2015
2015_810_ISEGS	Unknown Small Bird	UNID	Carcass Survey	10/26/2015	10/26/2015	Feather spot	2 weeks	Feather spot size small, consisting of 2 rectrices, 3 secondaries, and 40 body feathers. No evidence of collision or singe.	Unknown	NA	3	Powerblock	637462, 3937933	NA
2015_811_ISEGS	Unknown Small Bird	UNID	Carcass Survey	10/26/2015	10/26/2015	Feather spot	3-6 days	Feather spot size small, consisting of 12 body feathers. Evidence of singe on 3 feathers.	Scorched or singed	3	3	Powerblock	637476, 3937913	NA
2015_812_ISEGS	Horned Lark	HOLA	Carcass Survey	10/26/2015	10/26/2015	Broken up	2 weeks	Broken up carcass consisting of 6 rectrices and 10 body feathers attached by piece of dried skin. No evidence of	Unknown	NA	3	Powerblock	637469, 3937912	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
								collision or singe.						
2015_813_ISEGS	Unknown Small Bird	UNID	Carcass Survey	10/26/2015	10/26/2015	Feather spot	3-6 days	Feather spot size large, consisting of 23 body feathers. Evidence of singeing on tips of several body feathers.	Scorched or singed	Unk	3	Powerblock	637407, 3937946	NA
2015_814_ISEGS	Unknown Warbler	UNWA	Carcass Survey	10/26/2015	10/26/2015	Broken up	3-6 days	Broken up carcass consisting of partial wing with skin and additionally 3 primaries, 2 coverts, 1 secondary.No evidence of collision or singe.	Unknown	NA	3	Powerblock	637453, 3937962	LKF corrected Scientific Name 18 Nov 2015
2015_815_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	10/27/2015	10/27/2015	Feather spot	3-6 days	Feather spot size large, consisting of 8 rectrices, 1 secondary, 70 contour feathers. No evidence of collision or singe.	Unknown	NA	3	Heliostat	637417, 3938131	NA
2015_816_ISEGS	Northern Flicker	NOFL	Carcass Survey	10/27/2015	10/27/2015	Feather spot	3-6 days	Feather spot size small, consisting of 5 secondaries, 1 partial secondary, 1 body. No evidence of collision or singe.	Unknown	NA	3	Heliostat	636579, 3938117	NA
2015_817_ISEGS	White-Crowned Sparrow	WCSP	Incidental	10/28/2015	10/28/2015	Broken up	3-6 days	Broken up carcass consisting of 19 mantle feathers attached by dried skin, 30 body feathers (stuck on mirror), and 2 rectrices. Evidence of collision by imprint and residing body feathers stuck on heliostat mirror.	Collision with solar panel/heliostat	NA	3	Heliostat	637942, 3937334	NA
2015_818_ISEGS	House Sparrow	HOSP	Incidental	10/29/2015	10/29/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Whole carcass. Evidence of singeing to all major flight feathers, head, back, nape, breast, and rump.	Scorched or singed	2/3	2	Powerblock	638656, 3935843	NA
2015_819_ISEGS	Sage Thrasher	SATH	Carcass Survey	11/2/2015	11/2/2015	Feather spot	3-6 days	Feather spot size = large. 8 primaries, 5 secondaries, 50+ body feathers. No singe.	Unknown	NA	2	Heliostat	638409, 3936432	LKF corrected Scientific Name 7 Nov 2015.
2015_820_ISEGS	Western Meadowlark	WEME	Carcass Survey	11/2/2015	11/2/2015	Alive, injured	0-8 hours	Alive. Bill broken and bloody at lower mandible. No singe.	Collision with solar panel/heliostat	NA	2	Heliostat	638461, 3937218	NA
2015_821_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	11/2/2015	11/2/2015	Feather spot	2 days	Feather spot size large, consisting of 8 rectrices, 7 primaries, 10 secondaries, 100 body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	638128, 3937144	BLM corrected Scientific Name 29 Dec 2015
2015_822_ISEGS	Horned Lark	HOLA	Carcass Survey	11/3/2015	11/3/2015	Feather spot	3-6 days	Feather spot large, comprised of 6 secondaries, 1 trailing secondary, >150 body feathers, 2 rectrices, 2 wing coverts. No evidence of flux or collision.	Unknown	NA	2	Heliostat	639391, 3936814	NA
2015_823_ISEGS	Unknown Kinglet	UNKL	Carcass Survey	11/3/2015	11/3/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Carcass found whole, 90% of feathers singed off. Extensive damage. Grades 2 and 3 flux.	Scorched or singed	2/3	2	ACC Building	638649, 3935881	LKF corrected SPITS code, Species Common Name 7 Nov

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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
														2015.
2015_824_ISEGS	Cedar Waxwing	CEWA	Carcass Survey	11/3/2015	11/3/2015	Feather spot	3-6 days	Feather spot large. Comprised of 2 rects, 2 primaries, >40 body feathers. Singe on some body feathers, curling and singe on all flight feathers. Grades 3 and at least Grade 1 flux, unknown if up to Grade 2 flux.	Scorched or singed	1/3	2	Powerblock	638671, 3935866	NA
2015_825_ISEGS	Cactus Wren	CACW	Carcass Survey	11/3/2015	11/3/2015	Feather spot	3-6 days	Feather spot large. 16 primaries, 9 secondaries, 9 rectrices, >200 body feathers. No evidence of collision or flux.	Unknown	NA	2	Heliostat	639491, 3936951	NA
2015_826_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/3/2015	11/3/2015	Feather spot	2 weeks	Feather spot large. 1 primary, 13 body feathers. Singe on 4 body feathers. Grade 3 flux and unknown further flux damage.	Scorched or singed	3	2	Powerblock	638637, 3935862	NA
2015_827_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/3/2015	11/3/2015	Feather spot	2 weeks	Feather spot large. 20 body feathers found. Singe on 1 body feather. Grade 3 and unknown further grades of flux.	Scorched or singed	3	2	Solar Concentrating Tower	638652, 3935845	LKF clarified Project Feature 7 Nov 2015
2015_828_ISEGS	Violet-green Swallow	VGSW	Incidental	11/5/2015	11/5/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 weeks	Whole carcass found. No evidence of collision or singeing.	Unknown	NA	1	Powerblock	640361, 3933466	CJM clarified Project Feature on 29 December 2015
2015_829_ISEGS	Unknown Dove	UNDV	Incidental	11/6/2015	11/6/2015	Feather spot	2 weeks	Feather spot size large, consisting of 70 body feathers, 2 broken flight feathers. Evidence of collision with heliostat imprint.	Collision with solar panel/heliostat	NA	1	Heliostat	640726, 3933899	BLM corrected Scientific Name 29 Dec 2015
2015_830_ISEGS	Unknown Small Bird	UNID	Incidental	11/6/2015	11/6/2015	Feather spot	2 days	Feather spot size small, consisting of 26 body feathers. No evidence of collision or singe.	Unknown	NA	1	Heliostat	640162, 3934113	NA
2015_831_ISEGS	American Kestrel	AMKE	Carcass Survey	11/7/2015	11/7/2015	Dead, semi-fresh (eyes desiccated, rigor mortis)	2 days	Carcass found. Curling to all major flight feathers, singeing to top of head, left and right sides of face, throat, upper breast axillaries, coverts.	Scorched or singed	2/3	1	ACC Building	640396, 3933521	NA
2015_832_ISEGS	House Finch	HOFI	Carcass Survey	11/7/2015	11/7/2015	Mummified	2 weeks	Whole carcass. Evidence of curling on right wing primaries and all rectrices. Singe on left wing primaries, top of head, breast, and axillaries.	Scorched or singed	2/3	1	ACC Building	640359, 3933530	NA
2015_833_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/7/2015	11/7/2015	Broken up	3-6 days	Partial right wing, 3 rectrices, >30 body feathers.	Unknown	NA	1	ACC Building	640416, 3933553	NA
2015_834_ISEGS	American Pipit	AMPI	Carcass Survey	11/7/2015	11/7/2015	Dead, fresh (eyes moist)	8-24 hours	Probable collision, found within 1 foot of heliostat with no external signs of injury. Whole carcass.	Collision with solar panel/heliostat	NA	1	Heliostat	640478, 3933604	NA
2015_835_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	11/7/2015	11/7/2015	Feather spot	3-6 days	Feather spot small. 1 rectrice, 3 primaries, 4 coverts, >15 body feathers recovered. No evidence of collision or singe.	Unknown	NA	1	Heliostat	640503, 3933589	BLM corrected Scientific Name 29 Dec 2015

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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
2015_836_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/7/2015	11/7/2015	Feather spot	3-6 days	Feather spot size large, consisting of 3 primaries, 3 other remiges, 50 body feathers. Evidence of singeing on flight feathers and body feathers.	Scorched or singed	3	1	Powerblock	640403, 3933505	NA
2015_837_ISEGS	Unknown Warbler	UNWA	Carcass Survey	11/7/2015	11/7/2015	Feather spot	2 weeks	Feather spot small. 1 secondary, 6 rectrices, 1 undertail covert, 1 body feather recovered. Singe on secondary.	Scorched or singed	Unk	1	Powerblock	640401, 3933506	BLM corrected Scientific Name 29 Dec 2015
2015_838_ISEGS	Unknown Sparrow	UNSP	Carcass Survey	11/7/2015	11/7/2015	Feather spot	2 days	Feather spot small. 1 secondary, >50 body feathers recovered.	Unknown	NA	1	Heliostat	640615, 3933503	BLM corrected Scientific Name 29 Dec 2015
2015_839_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/7/2015	11/7/2015	Feather spot	3-6 days	Feather spot small. 1 primary, 1 secondary, 25 body feathers found. No evidence of collision or flux.	Unknown	NA	1	Heliostat	640530, 3933485	NA
2015_840_ISEGS	Unknown Small Bird	UNID	Carcass Survey	11/7/2015	11/7/2015	Feather spot	3-6 days	Feather spot small. 1 primary, 1 secondary, >35 body feathers recovered. Singe present on remiges.	Scorched or singed	Unk	1	Heliostat	640282, 3933391	NA
2015_841_ISEGS	Vesper Sparrow	VESP	Carcass Survey	11/7/2015	11/7/2015	Feather spot	2 weeks	Feather spot large. 2 rectrices, 5 primaries, 1 secondary, >50 body feathers recovered. No evidence of singe or collision.	Unknown	NA	1	Heliostat	640483, 3933284	NA
2015_842_ISEGS	Black-Throated Sparrow	BTSP	Incidental	11/10/2015	11/10/2015	Mummified	3-6 days	Whole carcass. Singe on crown, flanks, scapular.	Scorched or singed	3	2	Powerblock	638658, 3935844	NA
2015_843_ISEGS	American Kestrel	AMKE	Carcass Survey	11/17/2015	11/17/2015	Broken up	2 weeks	Broken up carcass consisting of partial right wing. Evidence of singeing on flight and covert feathers.	Scorched or singed	Unk	3	Heliostat	637230, 3937938	NA
2015_844_ISEGS	Yellow Warbler	YWAR	Carcass Survey	11/17/2015	11/17/2015	Broken up	3-6 days	Broken up carcass intact minus head. No evidence of collision or singe.	Unknown	NA	3	Heliostat	637649, 3938078	NA
2015_845_ISEGS	American Pipit	AMPI	Carcass Survey	11/17/2015	11/17/2015	Broken up	8-24 hours	Broken up carcass consisting of 2 primaries and a primary and covert attached by flesh, 10 rectrices, 14 secondaries, 150 body feathers. No evidence of singe or collision.	Unknown	NA	3	Heliostat	637451, 3938129	NA
2015_846_ISEGS	Barn Swallow	BARS	Incidental	11/17/2015	11/17/2015	Mummified	2 weeks	Whole carcass. Evidence of curling on primaries and tail, singeing on right flank.	Scorched or singed	2/3	2	Solar Concentrating Tower	638660, 3935845	CJM clarified Project Feature on 29 December 2015
2015_847_ISEGS	Western Meadowlark	WEME	Carcass Survey	11/18/2015	11/18/2015	Feather spot	3-6 days	Feather spot size large, consisting of 3 rectrices, 9 flight feathers, and 100 body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	638978, 3936202	NA
2015_848_ISEGS	White-Crowned Sparrow	WCSP	Carcass Survey	11/18/2015	11/18/2015	Feather spot	3-6 days	Feather spot size large, consisting of 8 rectrices, 5 secondaries, 8 primaries, 1 tertial, 3 greater coverts, 2 primary coverts, and 250 body	Unknown	NA	2	Heliostat	639166, 3935954	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	Nearest Project Feature	UTM Coordinates	SPUT Revisions
								feathers. No evidence of singe or collision.						
2015_849_ISEGS	Greater Roadrunner	GRRO	Carcass Survey	11/18/2015	11/18/2015	Feather spot	3-6 days	Feather spot size small, consisting of 11 body feathers. No evidence of collision or singe.	Unknown	NA	2	Heliostat	639116, 3935954	NA
2015_850_ISEGS	Ruby-crowned Kinglet	RCKI	Carcass Survey	11/23/2015	11/23/2015	Dead, fresh (eyes moist)	8-24 hours	Left side of face singed, curling to middle Retricies coverts in both wings singed	Scorched or singed	1/3	2	Heliostat	638807, 3935888	NA
2015_851_ISEGS	Unknown Small Bird	UNID	Carcass Survey	12/4/2015	12/4/2015	Feather spot	2 weeks	Feather spot size = small. 12 body feathers, 1 primary. Primary with singe, half of body feathers with singe.	Scorched or singed	Unk	1	Powerblock	640415, 3933500	NA
2015_852_ISEGS	Eared Grebe	EAGR	Incidental	12/6/2015	12/6/2015	Dead, fresh (eyes moist)	0-8 hours	Whole Carcass, Collision. Tip of bill Broken. No singe.	collision (Other)	NA	1	Powerblock	640372, 3933486	NA
2015_853_ISEGS	Cactus Wren	CACW	Carcass Survey	12/7/2015	12/7/2015	Feather spot	3-6 days	Feather spot size = small. 50 + body feathers. No singe.	Unknown	NA	2	Heliostat	639315, 3935747	NA
2015_854_ISEGS	Unknown Hummingbird	UNHU	Carcass Survey	12/8/2015	12/8/2015	Dead, Semi-fresh (eyes desiccated, rigor mortis)	3-6 days	Whole Carcass; majority of body singed, wings and tail curled	Scorched or singed	2/3	3	ACC Building	637447, 3937955	BLM corrected Scientific Name 29 Dec 2015
2015_855_ISEGS	Unknown Warbler	UNWA	Carcass Survey	12/8/2015	12/8/2015	Broken up	2 weeks	Partial Right Wing, Small skull fragment and 15+ body feathers. Curling and singe present on primary	Scorched or singed	Unk	3	Powerblock	637494, 3937963	BLM corrected Scientific Name 29 Dec 2015

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	Collector Line	Estimator Notes
2015_805_ISEGS	UNID	Inner HD	114	Small	Feather Spot	unknown	Fatality Search	7	Yes	X		X				
2015_806_ISEGS	UNID	Outer Segment	1170	Small	Feather Spot	unknown	Incidental	NA	No				X			Older than Search Interval
2015_807_ISEGS	BARS	Power Block	0	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_808_ISEGS	WCSP	Outer Segment	945	Small	Small Carcass	unknown	Incidental	NA	No				X			Older than Search Interval
2015_809_ISEGS	UNFI	Power Block	22	Small	Feather Spot	singed	Fatality Search	7	Yes	X	X					
2015_810_ISEGS	UNID	Power Block	26	Small	Feather Spot	unknown	Fatality Search	7	No	X	X					Older than Search Interval
2015_811_ISEGS	UNID	Power Block	0	Small	Feather Spot	singed	Fatality Search	7	Yes	X	X					
2015_812_ISEGS	HOLA	Power Block	0	Small	Feather Spot	unknown	Fatality Search	7	No	X	X					Older than Search Interval
2015_813_ISEGS	UNID	Power Block	73	Small	Feather Spot	singed	Fatality Search	7	Yes	X	X					
2015_814_ISEGS	UNWA	Power Block	56	Small	Feather Spot	unknown	Fatality Search	7	Yes	X	X					
2015_815_ISEGS	WCSP	Inner HD	229	Small	Feather Spot	unknown	Fatality Search	8	Yes	X		X				
2015_816_ISEGS	NOFL	Outer Segment	917	Large	Feather Spot	unknown	Fatality Search	7	No				X			Outside Standard Search Area
2015_817_ISEGS	WCSP	Outer Segment	734	Small	Feather Spot	collision	Incidental	NA	No				X			Older than Search Interval
2015_818_ISEGS	HOSP	Power Block	0	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_819_ISEGS	SATH	Inner Segment	612	Small	Feather Spot	unknown	Fatality Search	13	Yes				X			
2015_820_ISEGS	WEME	Outer Segment	1387	Small	Small Carcass	collision	Fatality Search	12	Yes				X			
2015_821_ISEGS	UNSP	Outer Segment	1408	Small	Feather Spot	unknown	Fatality Search	12	Yes				X			
2015_822_ISEGS	HOLA	Outer Segment	1230	Small	Feather Spot	unknown	Fatality Search	12	Yes				X			
2015_823_ISEGS	UNKL	ACC	37	Small	Small Carcass	singed	Fatality Search	14	Yes	X	X					
2015_824_ISEGS	CEWA	Power Block	24	Small	Feather Spot	singed	Fatality Search	14	Yes	X	X					
2015_825_ISEGS	CACW	Outer Segment	1400	Small	Feather Spot	unknown	Fatality Search	12	Yes				X			
2015_826_ISEGS	UNID	Power Block	27	Small	Feather Spot	singed	Fatality Search	14	No	X	X					Older than Search Interval
2015_827_ISEGS	UNID	Power Block	0	Small	Feather Spot	singed	Fatality Search	14	No	X	X					Older than Search Interval
2015_828_ISEGS	VGSW	Power Block	24	Small	Small Carcass	unknown	Incidental	1(1)	No	X	X					Older than Search Interval
2015_829_ISEGS	UNDV	Inner Segment	542	Large	Feather Spot	collision	Incidental	16	No				X			Outside Standard Search Area
2015_830_ISEGS	UNID	Inner Segment	660	Small	Feather Spot	unknown	Incidental	16	No				X			Outside Standard Search Area
2015_831_ISEGS	AMKE	ACC	42	Large	Large Carcass	singed	Fatality Search	17	Yes	X	X					
2015_832_ISEGS	HOFI	ACC	45	Small	Small Carcass	singed	Fatality Search	17	Yes	X	X					
2015_833_ISEGS	UNID	Power Block	79	Small	Feather Spot	unknown	Fatality Search	17	Yes	X	X					
2015_834_ISEGS	AMPI	Inner HD	157	Small	Small Carcass	collision	Fatality Search	17	Yes	X		X				
2015_835_ISEGS	UNSP	Inner HD	166	Small	Feather Spot	unknown	Fatality Search	17	Yes	X		X				
2015_836_ISEGS	UNID	Power Block	35	Small	Feather Spot	singed	Fatality Search	17	Yes	X	X					
2015_837_ISEGS	UNWA	Power Block	34	Small	Feather Spot	singed	Fatality Search	17	Yes	X	X					
2015_838_ISEGS	UNSP	Inner HD	243	Small	Feather Spot	unknown	Fatality Search	17	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	Collector Line	Estimator Notes
2015_839_ISEGS	UNID	Inner HD	157	Small	Feather Spot	unknown	Fatality Search	17	Yes	X		X				
2015_840_ISEGS	UNID	Inner HD	131	Small	Feather Spot	singed	Fatality Search	17	Yes	X		X				
2015_841_ISEGS	VESP	Inner HD	230	Small	Feather Spot	unknown	Fatality Search	17	Yes	X		X				
2015_842_ISEGS	BTSP	Power Block	40	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_843_ISEGS	AMKE	Inner HD	234	Large	Large Carcass	singed	Fatality Search	21	Yes	X		X				
2015_844_ISEGS	YWAR	Inner HD	245	Small	Small Carcass	unknown	Fatality Search	21	Yes	X		X				
2015_845_ISEGS	AMPI	Inner HD	218	Small	Feather Spot	unknown	Fatality Search	21	Yes	X		X				
2015_846_ISEGS	BARS	Power Block	0	Small	Small Carcass	singed	Incidental	1(1)	No	X	X					Older than Search Interval
2015_847_ISEGS	WEME	Inner Segment	483	Small	Feather Spot	unknown	Fatality Search	16	Yes				X			
2015_848_ISEGS	WCSP	Inner Segment	505	Small	Feather Spot	unknown	Fatality Search	16	Yes				X			
2015_849_ISEGS	GRRO	Inner Segment	505	Large	Feather Spot	unknown	Fatality Search	16	Yes				X			
2015_850_ISEGS	RCKI	Inner HD	154	Small	Small Carcass	singed	Fatality Search	19	Yes	X		X				
2015_851_ISEGS	UNID	Power Block	44	Small	Feather Spot	singed	Fatality Search	27	Yes	X	X					
2015_852_ISEGS	EAGR	Power Block	0	Large	Large Carcass	collision	Incidental	1(1)	Yes	X	X					
2015_853_ISEGS	CACW	Inner Segment	668	Small	Feather Spot	unknown	Fatality Search	6	Yes				X			
2015_854_ISEGS	UNHU	ACC	38	Small	Small Carcass	singed	Fatality Search	22	Yes	X	X					
2015_855_ISEGS	UNWA	Power Block	55	Small	Small Carcass	singed	Fatality Search	22	Yes	X	X					
2015_856_ISEGS	UNID	Inner HD	153	Small	Feather Spot	unknown	Fatality Search	22	Yes	X		X				
2015_857_ISEGS	CACW	Outer Segment	807	Small	Feather Spot	unknown	Fatality Search	27	Yes				X			
2015_858_ISEGS	DEJU	Power Block	22	Small	Small Carcass	unknown	Incidental	1(1)	No	X	X					Older than Search Interval
2015_859_ISEGS	UNID	Power Block	8	Small	Feather Spot	singed	Fatality Search	17	Yes	X	X					
2015_860_ISEGS	UNID	Power Block	9	Small	Feather Spot	singed	Fatality Search	17	Yes	X	X					
2016_001_ISEGS	WEGR	Inner HD	225	Large	Feather Spot	unknown	Fatality Search	29	Yes	X		X				
2016_002_ISEGS	WCSP	Inner HD	179	Small	Feather Spot	singed	Fatality Search	29	Yes	X		X				
2016_003_ISEGS	WCSP	Inner HD	182	Small	Feather Spot	unknown	Fatality Search	29	Yes	X		X				
2016_004_ISEGS	WCSP	Inner HD	195	Small	Feather Spot	unknown	Fatality Search	29	Yes	X		X				
2016_005_ISEGS	CACW	Inner HD	190	Small	Feather Spot	unknown	Fatality Search	29	Yes	X		X				
2016_006_ISEGS	CACW	Inner Segment	404	Small	Feather Spot	unknown	Fatality Search	29	Yes				X			
2016_007_ISEGS	RCKI	ACC	69	Small	Small Carcass	singed	Fatality Search	24	No	X	X					Older than Search Interval
2016_008_ISEGS	NOMO	Power Block	25	Small	Feather Spot	unknown	Fatality Search	24	Yes	X	X					
2016_009_ISEGS	WCSP	Inner HD	146	Small	Small Carcass	collision	Fatality Search	16	Yes	X		X				
2016_010_ISEGS	YWAR	Outside Search - Tower	33	Small	Small Carcass	singed	Incidental	NA	No							Outside Standard Search Area
2016_011_ISEGS	HOLA	Inner Segment	547	Small	Feather Spot	unknown	Fatality Search	16	No				X			Older than Search Interval
2016_012_ISEGS	GHOW	Unit Fence	1445	Large	Large Carcass	unknown	Incidental	97	No					X		Older than Search Interval
2016_013_ISEGS	WCSP	Inner Segment	484	Small	Feather Spot	unknown	Fatality Search	22	Yes				X			
2016_014_ISEGS	UNID	Inner Segment	687	Small	Feather Spot	unknown	Fatality Search	22	Yes				X			
2016_015_ISEGS	UNID	Outer Segment	1084	Small	Feather Spot	unknown	Fatality Search	24	Yes				X			
2016_016_ISEGS	CACW	Outer Segment	800	Small	Feather Spot	unknown	Fatality Search	24	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	Collector Line	Estimator Notes
2016_017_ISEGS	UNSP	Power Block	45	Small	Small Carcass	unknown	Fatality Search	25	Yes	X	X					
2016_018_ISEGS	UNID	Inner HD	208	Small	Feather Spot	unknown	Fatality Search	27	Yes	X		X				
2016_019_ISEGS	WEME	Inner HD	215	Small	Feather Spot	unknown	Fatality Search	27	Yes	X		X				
2016_020_ISEGS	ANHU	Inner HD	137	Small	Small Carcass	singed	Fatality Search	27	Yes	X		X				
2016_021_ISEGS	BTSP	ACC	72	Small	Small Carcass	unknown	Fatality Search	17	Yes	X	X					
2016_022_ISEGS	UNGR	Power Block	10	Large	Feather Spot	unknown	Fatality Search	17	Yes	X	X					
2016_023_ISEGS	GRRO	Unit Fence	1401	Large	Feather Spot	unknown	Incidental	116	No					X		Older than Search Interval
2016_024_ISEGS	NOFL	Inner HD	225	Large	Feather Spot	unknown	Fatality Search	26	Yes	X		X				
2016_025_ISEGS	ANHU	Power Block	30	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2016_026_ISEGS	WEME	Inner Segment	623	Small	Feather Spot	unknown	Fatality Search	26	Yes				X			
2016_027_ISEGS	COHU	Power Block	16	Small	Small Carcass	singed	Fatality Search	16	Yes	X	X					
2016_028_ISEGS	UNSP	Power Block	28	Small	Feather Spot	singed	Fatality Search	16	Yes	X	X					
2016_029_ISEGS	COHU	Power Block	71	Small	Small Carcass	singed	Fatality Search	16	Yes	X	X					
2016_030_ISEGS	COHU	Power Block	63	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2016_031_ISEGS	HOFI	ACC	52	Small	Small Carcass	singed	Fatality Search	26	Yes	X	X					
2016_034_ISEGS	ANHU	ACC	63	Small	Small Carcass	singed	Fatality Search	20	Yes	X	X					
2016_035_ISEGS	TRES	Power Block	80	Small	Small Carcass	singed	Incidental	1(1)	Yes	X	X					
2016_036_ISEGS	VGSW	Inner HD	163	Small	Feather Spot	singed	Fatality Search	21	Yes	X		X				
2016_037_ISEGS	VGSW	Inner HD	155	Small	Small Carcass	singed	Fatality Search	21	Yes	X		X				
2016_038_ISEGS	HOLA	Inner HD	219	Small	Feather Spot	unknown	Fatality Search	21	Yes	X		X				
2016_039_ISEGS	HOLA	Inner HD	190	Small	Feather Spot	unknown	Fatality Search	21	Yes	X		X				
2016_040_ISEGS	UNSW	Inner HD	209	Small	Small Carcass	singed	Fatality Search	21	Yes	X		X				
2016_041_ISEGS	LISP	Inner HD	210	Small	Small Carcass	unknown	Fatality Search	21	Yes	X		X				
2016_042_ISEGS	UNID	Inner HD	218	Small	Small Carcass	unknown	Fatality Search	21	Yes	X		X				
2016_043_ISEGS	COHU	Power Block	51	Small	Small Carcass	singed	Fatality Search	25	Yes	X	X					
2016_044_ISEGS	COHU	Power Block	25	Small	Small Carcass	singed	Fatality Search	25	Yes	X	X					
2016_045_ISEGS	TRES	ACC	43	Small	Small Carcass	singed	Fatality Search	8	Yes	X	X					
2016_046_ISEGS	TRES	ACC	50	Small	Small Carcass	singed	Fatality Search	8	Yes	X	X					
2016_047_ISEGS	TRES	ACC	63	Small	Small Carcass	singed	Fatality Search	8	Yes	X	X					
2016_048_ISEGS	TRES	ACC	73	Small	Small Carcass	singed	Fatality Search	8	Yes	X	X					
2016_049_ISEGS	UNID	Inner HD	252	Small	Feather Spot	unknown	Fatality Search	10	Yes	X		X				
2016_050_ISEGS	UNID	Power Block	50	Small	Feather Spot	singed	Fatality Search	25	No	X	X					Older than Search Interval
2016_051_ISEGS	UNID	Power Block	5	Small	Feather Spot	unknown	Fatality Search	25	Yes	X	X					
2016_052_ISEGS	UNID	Inner HD	237	Small	Feather Spot	unknown	Fatality Search	10	Yes	X		X				
2016_053_ISEGS	UNSP	Inner HD	184	Small	Feather Spot	unknown	Fatality Search	10	Yes	X		X				
2016_054_ISEGS	HOLA	Power Block	13	Small	Small Carcass	singed	Fatality Search	9	Yes	X	X					
2016_055_ISEGS	LOSH	Outer Segment	1117	Small	Feather Spot	unknown	Fatality Search	24	Yes				X			
2016_056_ISEGS	UNID	Outer Segment	1342	Small	Feather Spot	unknown	Fatality Search	24	Yes				X			