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Post-Construction Monitoring at the Blythe Solar Power Project Riverside County, California

Final

2016 Fall Quarterly Interim Report

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EXECUTIVE SUMMARY

Avian and bat monitoring surveys were conducted from September 4 to October 29, 2016 (the fall reporting period) at the Blythe Solar Power Project (Project) in accordance with the Project's Bird and Bat Conservation Strategy (BBCS). The Project is a 485 megawatt (MW) photovoltaic (PV) solar energy facility consisting of four units, on approximately 1,675 hectares (ha; 4,138 acres) of Bureau of Land Management (BLM) -administered land in Riverside County, California. Unit 1 and Unit 2 have been designed, constructed, and will be included in the current monitoring study as blocks are turned-over. Unit 1 and 2 include approximately 810 ha (2,000 ac.). The solar arrays in these units total 235 MW made up of seven blocks and cover approximately 536 ha (1,326 ac.). The Project's 11.5-mile (18.5-kilometer) 230-kilovolt generation-interconnection line (gen-tie) extends south from the Project to the Colorado River Substation. Six of the seven solar array blocks were operational and surveyed as part of the fall monitoring study. Specifically, standardized carcass searches, searcher efficiency trials, and carcass persistence trials were conducted. This report represents the third seasonal report for the first year of monitoring, and summarizes monitoring methods and results for those surveys based on the procedures and requirements specified in the BBCS. This report is considered a preliminary summary of data and information for the single quarter. Data and final information from all four quarterly monitoring periods will be included in a comprehensive final annual report.

Included in this report are data from standardized carcass searches conducted during the fall season at the Project, defined as September 4 to October 29, 2016. Approximately 85% of the facility was turned over from construction and searched during the fall 2016 period. Standardized carcass searches were conducted: 1) in the turned-over solar arrays, consisting of a random stratified sample of 41% of the solar photovoltaic (PV) panels; 2) along inner portions of the perimeter fence resulting in approximately 92% of the length of the fence line; and 3) along 25% of the total length of gen-tie from the Project fence to the substation located south of Interstate 10. An additional 25% of the gen-tie was sampled as part of the McCoy Solar Energy Project (McCoy) monitoring study, resulting in 50% of the entire gen-tie being sampled. Searches were conducted approximately weekly during the fall season. All bird and bat carcasses and injuries or strandings found are referred to as detections in this report. Detections were found during scheduled search events and incidentally by WEST biologists and site personnel.

During fall 2016, 33 avian detections (including incidental detections) of 17 identified species and seven guilds were recorded. The most common identified species were Savannah sparrow with five detections and white-crowned sparrow with three detections. All other species found were represented by two or fewer detections. Most detections (26 detections; 78.8% of total detections) occurred along the gen-tie. Four detections (12.1%) occurred along the fence line, and three detections occurred at other project infrastructure (two of these occurred near the solar arrays, but were greater than 10 meters from an array and under overhead lines). Twenty-two (66.7%) of the 33 detections were located during standardized carcass searches and 11

(33.3%) were documented as incidental detections. No live injured or stranded birds were found during the fall period. No bats were detected during the fall season.

During the reporting period, carcass persistence was influenced by carcass size and Project component. Sample sizes placed within the solar arrays during fall 2016 for carcass persistence trials included 30 small, 20 medium, and 10 large bird carcasses. Along the non-searched gen-tie segments, 25 small, 15 medium, and 10 large carcasses were placed and monitored. Carcass persistence rates presented in this report were informed by data from three seasons (spring, summer, and fall). Small carcasses in the arrays and along the fence (combined) had a 61.1% chance (90% CI: 55 – 67%) of persisting through the effective search interval, medium carcasses had a 68.1% (90% CI: 60 – 76%) chance, and large carcasses had a 95.5% chance (90% CI: 93 – 98%). Median removal times within the arrays for small, medium, and large trial carcasses were 4.6, 7.0, and 51.7 days, respectively. Along the gen-tie (pooled data for Blythe and McCoy), chances of persistence for small, medium, and large carcasses were 27.0% (90% CI: 21 – 32%), 35.0% (90% CI: 26 – 44%), and 47.4% (90% CI: 35 – 58%) respectively; median removal times for small, medium, and large carcasses were 1.1, 1.3, and 2.5 days, respectively.

For the solar arrays, searcher efficiency was modeled separately for small, medium, and large birds. Data from all three seasons (spring, summer, and fall) were used to inform the searcher efficiency models. Within the solar arrays, searcher efficiency was influenced by carcass size and distance from survey transects. The best model for small and medium birds was an exponential distribution. The best model for large birds was a half-normal distribution. Within the solar arrays, searcher efficiency was: 87.6% (90% CI: 78-97%) for large bird trial carcasses; 47.8% (90% CI: 35-61%) for medium bird trial carcasses; and 47.3% (90% CI: 40-56%) for small bird trial carcasses. For linear Project components, the distance sampling approach was not implemented, therefore the searcher efficiency rates were calculated based on the number available and number found along the fence line and gen-tie. Along the fence line, searcher efficiency was 91.9% (90% CI: 84-100%) for small bird trial carcasses, and 100% (no CI) for both medium and large bird trial carcasses. Along the gen-tie, searcher efficiency was 81.0% (90% CI: 70-92%) for small bird trial carcasses, 92.0% (90% CI: 80-100) for medium bird trial carcasses, and 100% (no CI) for large bird trial carcasses. The gen-tie included pooled trial data for the Blythe and McCoy Projects.

No fatality estimate was produced for the solar array during the fall 2016 monitoring, as no detections occurred in the solar array sample units. However, two incidental detections did occur near the solar arrays; but were greater than 10 m from a solar panel (outside of the search area).

The adjusted fatality estimate for the fence line was approximately six small bird fatalities (90% CI: *[3]* - 12) and approximately two medium bird fatalities (90% CI: *[1]* - 5). These estimates are based on three small bird and one medium bird detections along the fence. No large birds were detected along the fence line during the fall period.

Gen-tie fatality estimates included pooled McCoy and Blythe project data. The adjusted fatality estimate along the gen-tie was modeled at approximately 284 small bird fatalities (90% CI: 188 – 403) and approximately six medium bird fatalities (90% CI: *[1]* – 20). These estimates were based on 30 small bird detections and one medium bird detection in the gen-tie sample units. No large birds were found along the gen-tie sample units during the fall period. Assuming each project is responsible for half of the gen-tie, an estimate for the Blythe Project gen-tie would be 145 bird fatalities. Estimates of fatalities along the gen-tie were heavily influenced by the high rates of scavenging observed during the trials at the gen-tie (i.e., large correction factors) producing greater uncertainty in the estimate and a wide confidence interval.

STUDY PARTICIPANTS

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REPORT REFERENCE

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1.0 INTRODUCTION

1.1 Project Background

NextEra Blythe Solar Energy Center, LLC (NextEra Blythe Solar) developed the Blythe Solar Power Project (Project), a 485 megawatt (MW) photovoltaic (PV) solar energy facility, on approximately 1,675 hectares (ha; 4,138 acres) of Bureau of Land Management (BLM) -administered land in Riverside County, California (Figure 1). The Project consisted of four units. Unit 1 and Unit 2 have been designed, constructed, and included in the current monitoring study. Unit 1 and 2 include approximately 810 ha (2,000 ac.). The solar arrays for these units total 235 MW made up of seven blocks and cover approximately 536 ha (1,326 ac.). Six solar array blocks (approximately 85% of the total facility size; 205 MW) were operational and surveyed as part of the fall monitoring study. Renewable energy is provided to the California electrical grid through an interconnection at Southern California Edison's (SCE's) Colorado River Substation (CRS). The Project's 11.5-mile (18.5-kilometer) 230-kilovolt generation-interconnection line (gen-tie) extends south from the Project to the CRS.

1.2 Monitoring Plan Overview and Goals

A Bird and Bat Conservation Strategy (BBCS; Western EcoSystems Technology, Inc. [WEST] 2016) was prepared by the Project proponent in collaboration with the California Energy Commission (CEC), US Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and BLM to guide comprehensive monitoring of impacts to birds and bats associated with operation of the Project. The draft survey methods were approved by the agencies in February 2016 and final agency approval of the full BBCS document occurred in May 2016.

The BBCS details post-construction monitoring to be conducted and the data analysis and reporting processes that will be implemented by NextEra Blythe Solar in collaboration with the CEC, USFWS, CDFW, and BLM. As identified in the BBCS, these monitoring components are:

1. Estimate overall annual avian fatality rate and species composition associated with the Project infrastructure. This estimate will include mortality associated with solar arrays, overhead lines including the gen-tie line, perimeter fence and other features of the Project that may result in injury or fatality.
2. Determine whether there are spatial and temporal/seasonal patterns of mortality associated with project infrastructure (e.g., different fatality rates near panels on the edge of the arrays vs. the interior area of the arrays).
3. Provide information that will assist the BLM and CEC, in consultation with the USFWS and CDFW, in understanding which species and potentially which regional populations are at risk.
4. Collect data in such a way that the BLM and CEC, in consultation with the USFWS and CDFW, may make comparisons with other solar sites.

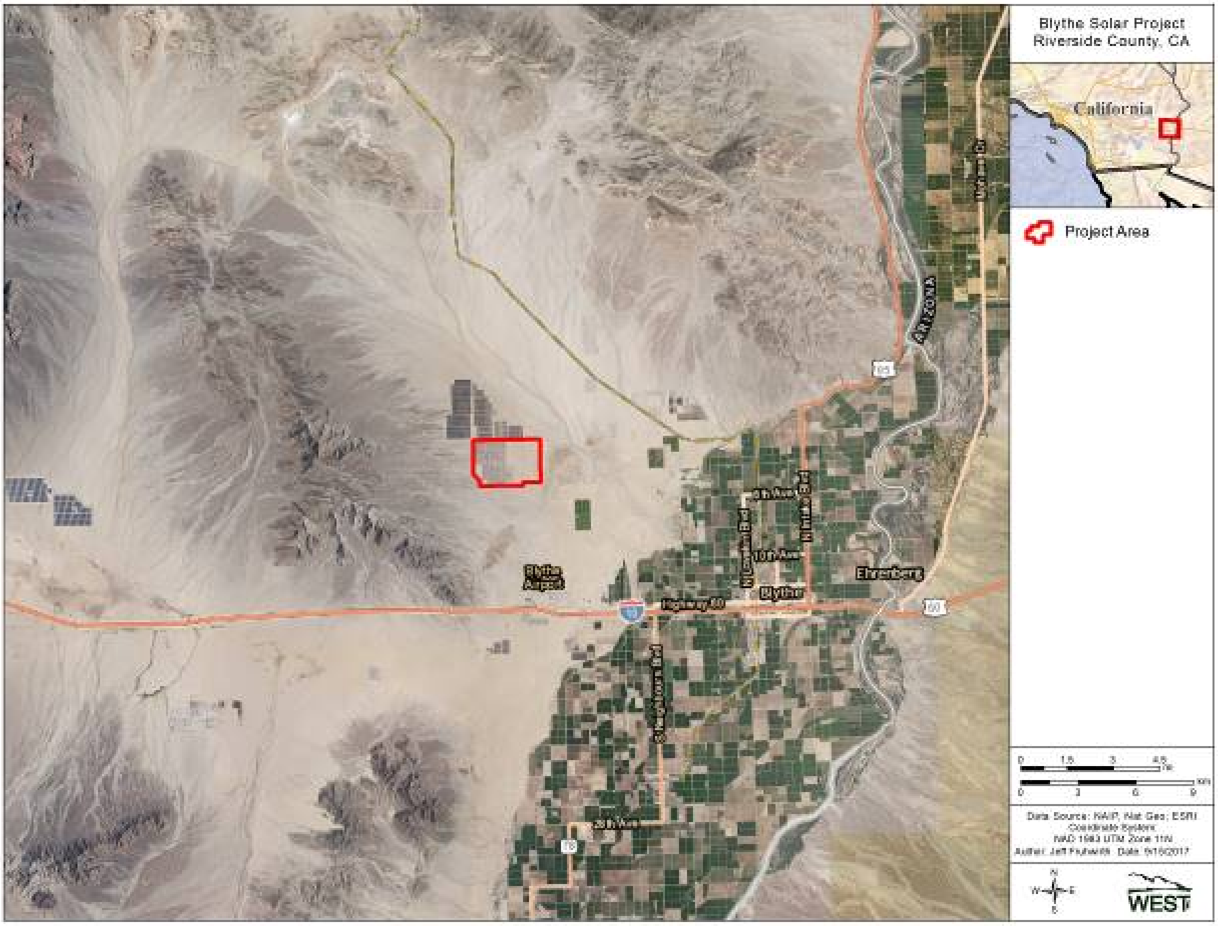

Figure 1. Blythe Solar Power Project vicinity map, Riverside County, California.

1.3 Purpose of This Report

This report summarizes the methods and results for the third quarter (fall) of the Year 1 monitoring study. Requirements specified in the BBCS are provided, including documentation of all avian and bat mortalities and injuries and results of completed bias trials. This quarterly report and the subsequent quarterly report will be considered preliminary summaries of data and information. It is assumed that bias trial data will become more accurate as additional data are collected and each subsequent report will use previously collected bias trial data to help inform modeling efforts. A comprehensive annual report will be prepared at the end of the Year 1 monitoring period that combines data and information from the four quarterly monitoring periods.

This quarterly report covers the fall 2016 period from September 4 through October 29, 2016. All carcasses and injured birds or bats discovered by observers (or other site personnel) are referred to as “detections”. Information relevant to each detection, including species, location, nearest Project infrastructure, suspected cause of death, and time since death, is provided. As stated in the approved BBCS (WEST 2016), detections were classified as resident or overwintering, and whether they are diurnal or nocturnal migrants (or both). Additionally, data on taxonomic family and ecological guild are provided. This report presents information related to the spatial distribution of detections, but no formal statistical analysis of the spatial distribution of carcasses will be conducted until the end of the monitoring year, given the limited data presently available. This report also provided information related to the bias trials. This information includes trial locations, size classes/species, number of trials placed, and results of the trials.

2.0 METHODS

The BBCS provides a detailed description of the monitoring and analysis methods implemented at the Project. An abridged description of these is provided below (see BBCS Section 4.0 for detailed methods; WEST 2016).

2.1 Standardized Carcass Searches

This section describes areas surveyed, search schedule, and the standardized search methods conducted to identify dead/injured birds and bats at the Project. This section also describes the methods for the carcass removal and searcher efficiency trials, how data were reported and analyzed, and the methods for producing fatality estimates for the Project.

2.1.1 *Areas Surveyed*

Standardized carcass searches were conducted at defined sample units within the Project's solar arrays (Tables 1 and 2; Figure 2); along the fence line for the Project (Table 2, Figure 2); and along the gen-tie (from the Project fence line to the CRS on the south side of Interstate-10; Table 2, Figure 3). As the Project was still under construction, the entire facility was not searched; only solar blocks that were fully operational and turned-over were searched. The turn-over date for each block and the first carcass search date are provided in Table 1. Detailed maps of detections along the gen-tie are presented in Appendix A. Overhead lines that occur within the solar array field (medium voltage overhead lines [MVOH]) were not specifically sampled as part of the monitoring plan. The MVOH were included as part of the standardized carcass searches only to the extent that they co-occurred with solar arrays included in the sample units.

Table 1. Block turnover and first search date during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project.

Block Identification	Turnover Date	First Carcass Search Date	Number of Survey Events
1	3/8/16	3/8/16	8
2	4/18/16	4/27/16	8
3	4/28/16	5/12/16	8
4	7/19/16	7/25/16	8
5	8/16/16	9/6/16	8
6	9/30/16	10/07/16	4
7*	N/A	N/A	0

*Not operational and turned over in fall 2016

Table 2. Areas included in standardized carcass searches at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Project Component	Total Size	Units	% of Available Component Searched
Solar arrays (available)	490.9[A]	Hectares	41.0
Fence line	11.5	Kilometers	92.0[B]
Gen-tie	18.5	Kilometers	~50.0[C]

A = Total size for the solar arrays only includes areas that were turned over and available for search during the fall 2016 period (Blocks 1 - 6).

B = One section was inaccessible along the fence line due to an environmentally sensitive area (total length approximately 950 m [3,117 ft]).

C = Project and McCoy gen-tie data were pooled for this report; each project is responsible for surveying 25%

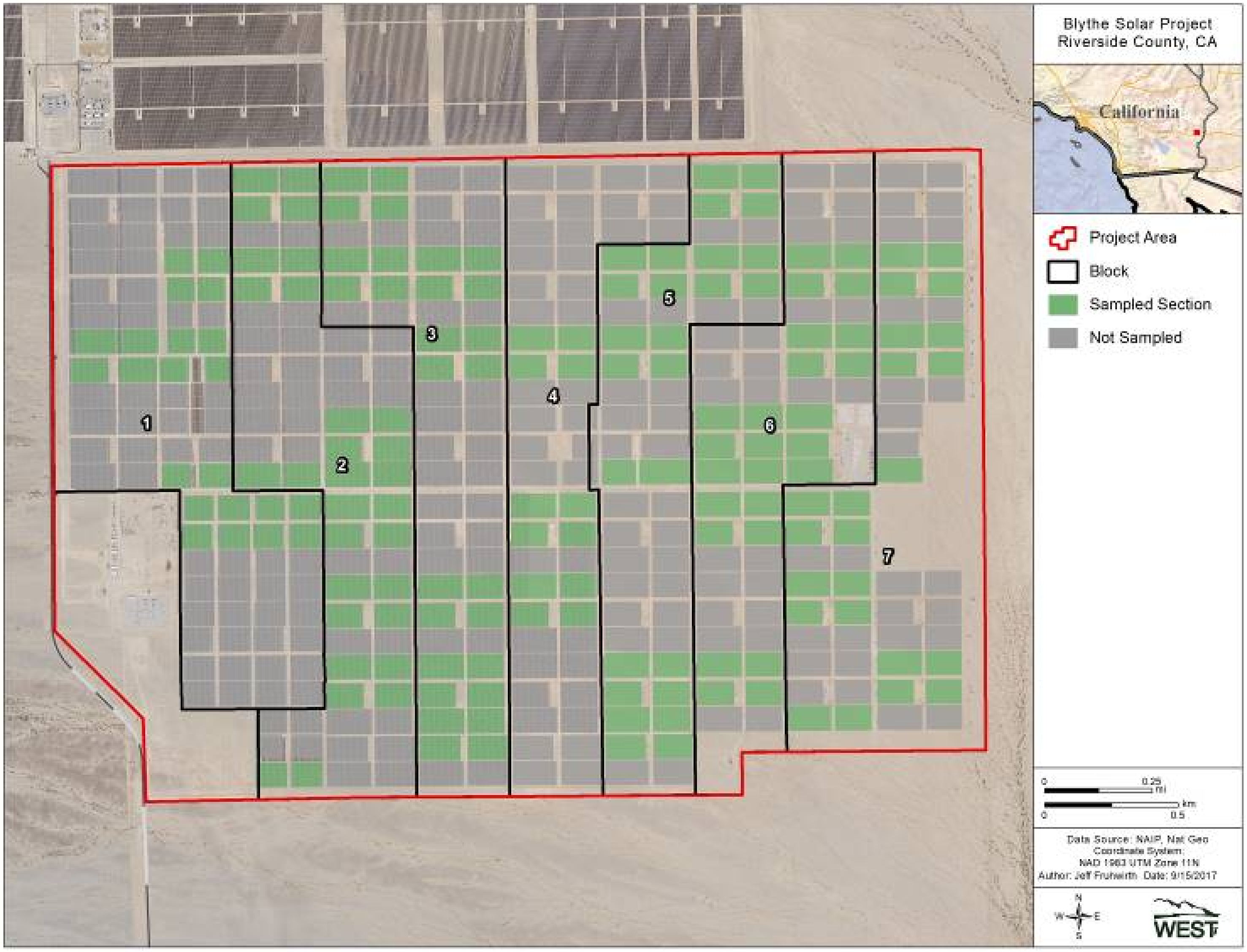

Figure 2. Areas of standardized searches at the Blythe Solar Power Project during fall (September 4 – October 29) 2016. Block 7 was not searched in fall 2016.

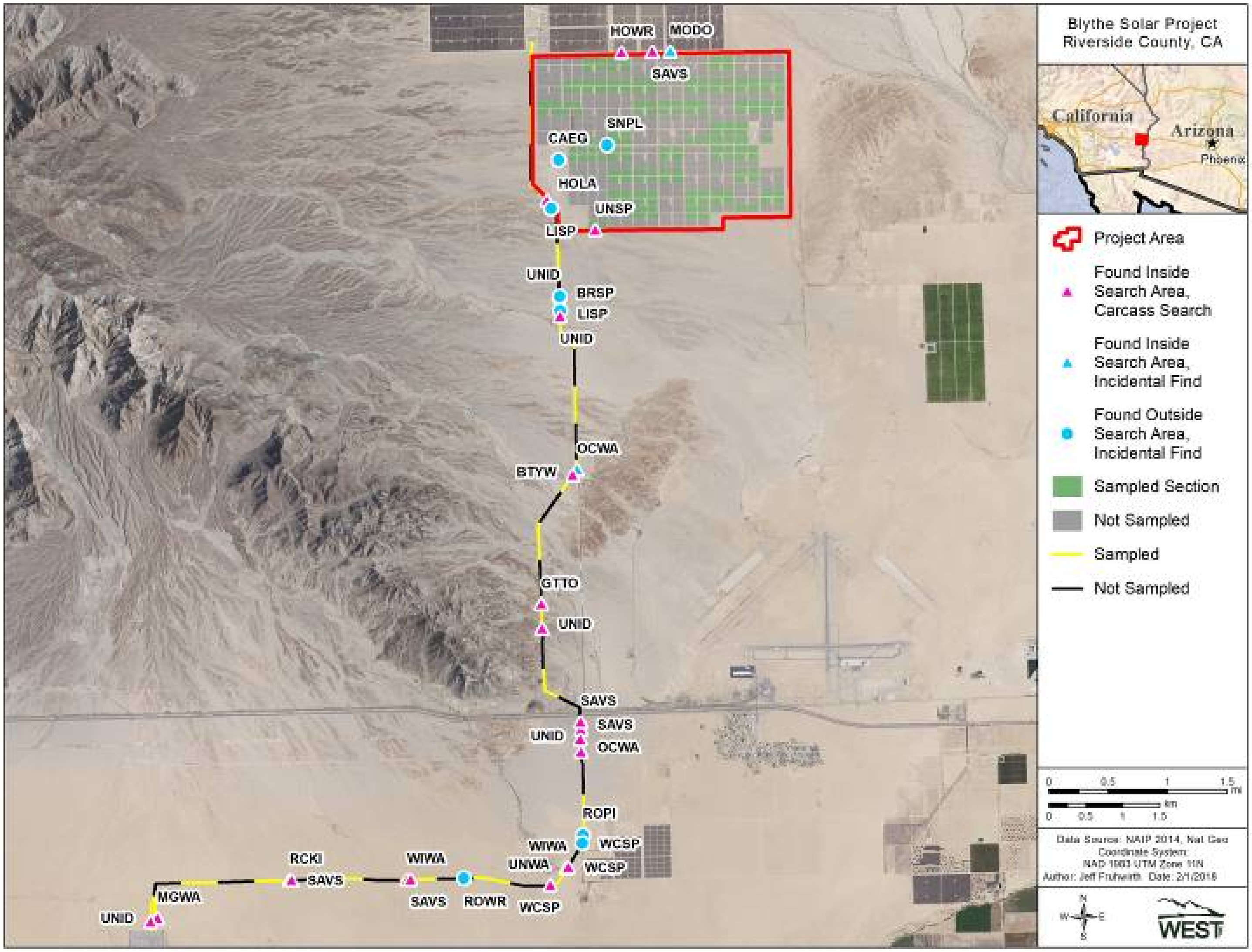

Figure 3. Areas of standardized searches and detections (those located during searches and as incidental detections) at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring. Detailed maps of detections along the gen-tie are presented in Appendix A.

Prior to initiating the study, the USFWS recommended changes to the monitoring protocol based on information gathered at other solar facilities (e.g., Desert Sunlight) and the recently published US Geological Survey's (USGS) solar fatality monitoring protocols (Huso et al. 2016). These changes included an increase to observers' viewsheds during the transect surveys by modifying the distance sampling transect layout and increasing the percent area of the solar field to be searched. This recommendation was made because the searcher efficiency rates were shown to be high for medium and large birds. It was determined that precision of fatality estimates could be increased for the same or less effort for medium to large birds (e.g. water-associated birds) by covering more arrays, but with less effort per sample unit (larger viewsheds). It was also expected that the precision for fatality estimates for small birds would be acceptable under the proposed changes to the search methods. This approach is suitable for the Project because of the openness of the viewsheds at the site resulting from limited vegetation cover and topographic relief.

Sample units at the Project were defined as an area that spanned between 42 and 63 rows of PV panels on the east/west axis, and 190 meters (m; 623 feet [ft]) on the north/south axis. To complete the survey, a biologist drove along the road that bisects the sample unit (Figure 4), providing a 95-m (312-ft) viewshed in each direction. Due to the variations in the facility layout, differences in viewsheds occurred among sample units, but the searcher viewshed never exceeded 95 m. The percent area sampled in fall 2016 was approximately 41% of the available facility. The BBCS states approximately 40% of the total facility will be sampled. During the fall season, six of the seven blocks were operational (i.e., available for surveys). Approximately 40% of the entire facility will be surveyed once all arrays are accessible for surveys.

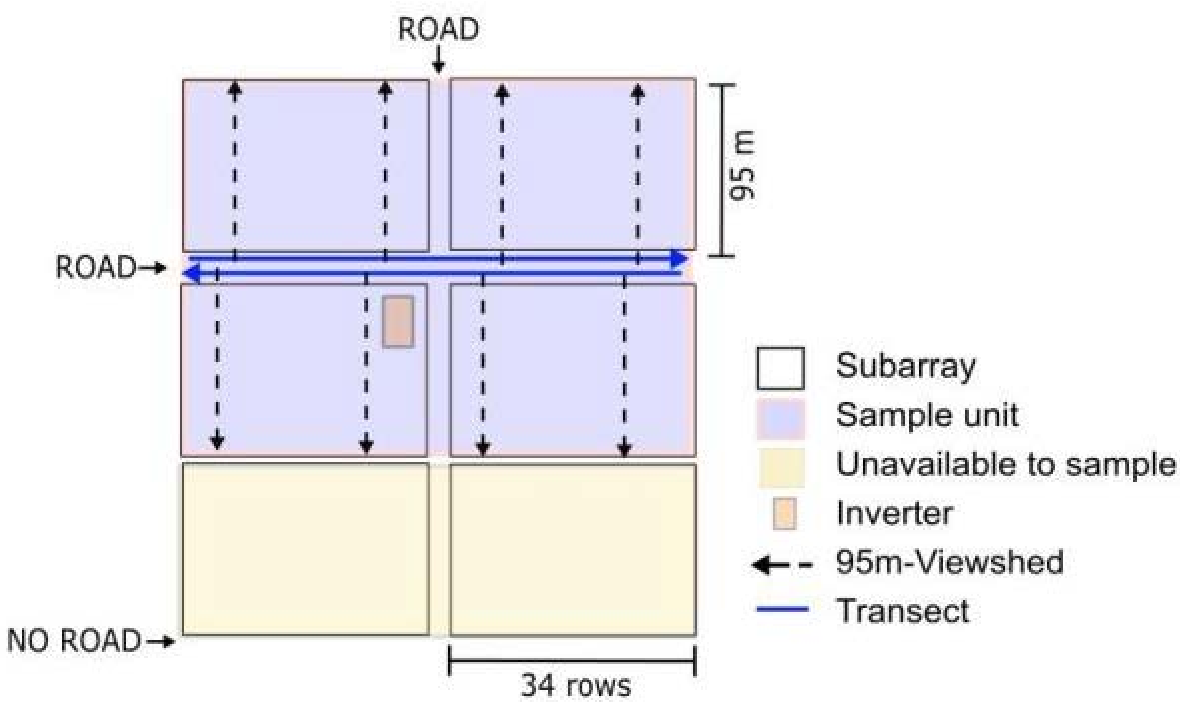

Figure 4. Survey method at the Blythe Solar Power Project during fall (September 4 – October 29) 2016.

2.1.2 *Search Frequency and Timing*

Standardized searches occurred during the third quarter (fall) of the Year 1 monitoring. This quarter included the period from September 4 through October 29, 2016. The fence line and gen-tie were surveyed eight times during fall. Blocks 1 through 5 of the solar arrays were surveyed eight times and block 6 was surveyed four times due to turnover of the block mid-season (Table 1).

As specified in the approved Blythe BBCS, the average search interval for all Project components included in standardized carcass searches during fall was seven days. Slight variations in search intervals occurred due to weather and scheduling logistics.

2.1.3 *Search Methods*

Standardized carcass searches were performed by CEC and BLM-approved biologists, in accordance with methods outlined in the BBCS.

Within the Project boundaries (inside the fence line), arrays of solar panels were surveyed by observers from a vehicle travelling less than five miles per hour (eight kilometers [km] per hour). Sampling units were surveyed from roads aligned along the edge of continuous solar panel rows by scanning between each row for potential mortalities, with each side-specific survey covering half the width of the sampling unit (Figure 4). An observer drove along east-west roads that bisect sampling units and scanned to the left (out of the driver's window), then turned around at a main road where space allowed. The observer looked to the left on the return trip, searching the opposite side of the unit. The observer scanned out to a maximum perpendicular distance of approximately 95 m from the transect. Observers used binoculars to verify a detection. Once a detection was confirmed, the distance from the detection to the transect line was estimated using a laser range finder.

When a carcass was detected, it was photographed and data were recorded following the specifications outlined in Section 4.2.5 of the approved Blythe BBCS. Carcasses were then retrieved from their location on the ground, labeled, and placed in a freezer on site.

The majority of the fence line (approximately 6.6 miles [10.6 km]; Figure 2) was searched from a vehicle using the standard protocol. Biologists searched a six-m (20-ft) wide strip transect centered on the fence line from the inner perimeter. Approximately four km of the fence line along the south McCoy Project boundary is shared between Blythe and McCoy. Detections that occurred along the shared fence line were documented based on the side of the fence they were found. One small section of the fence line could not be accessed for surveys. This section was approximately 950 m (3,117 ft) long on the eastern fence line. This area was designated an environmentally sensitive area with no access allowed.

The gen-tie was searched using a 30-m (98-ft) wide strip transect (i.e., 15 m [49 ft] of ground on either side of the overhead line). Sample units along the gen-tie were chosen by dividing the total length of line from the Project fence line south to the CRS into 500-m (1,640-ft) segments. Every other 500-m segment was included in the sampled areas. The Project was responsible for half of the sample segments (25% of the total line). Since the gen-tie is shared infrastructure, the McCoy Solar Energy Project (McCoy) was also responsible for surveying 25%; therefore, approximately 50% of the total gen-tie length was surveyed (Figure 3). Biologists slowly walked the 500-m segments of the line, meandering back and forth along the width of the strip transect, scanning for dead or injured birds or bats within 15 m of the overhead line.

For each detection, a suspected cause of death or injury was assigned based on evidence available from the detection, evidence available on Project infrastructure, and proximity of the detection to Project infrastructure. If there was not sufficient evidence to make a determination (e.g., detection was a feather spot), the detection was assigned an "unknown" value. Detections that were intact with signs of trauma (e.g., broken beak) and located in close proximity to Project infrastructure (e.g., found directly beneath overhead lines) had a suspected cause of death attributed to the respective Project component. However, it should be noted that there is substantial uncertainty associated with cause of death assignments because no events were directly observed. Detections assigned to the "unknown" category were included in fatality estimates if they were located within standardized carcass search areas. All detections recorded during the fall season are reported here.

2.2 Carcass Persistence Trials

Carcass persistence trials were conducted throughout the fall period. Carcasses from three size classes (small [0-100 grams (g)], medium [101-999 g], and large [1,000+ g]) were used for trials. The small trial carcasses were 2- to 3-week old Coturnix quail (*Coturnix coturnix*); the medium trial carcasses were adult Coturnix quail; and the large trial carcasses were female mallards (*Anas platyrhynchos*) and female ring-necked pheasants (*Phasianus colchicus*).

2.2.1 *Carcass Persistence Data Collection*

To quantify carcass persistence rates, 30 small, 20 medium, and 10 large trial carcasses were randomly placed and monitored within the solar arrays (including the fence line) during fall. Trials placed along the gen-tie were pooled between the Blythe and McCoy projects (i.e., 50 total along the gen-tie). A total of 110 carcass persistence trials were placed at the Project during the fall 2016 season, as specified in the approved Blythe BBCS (WEST 2016). By placing carcasses inside (within arrays and along the inner perimeter of the fence line) and outside (along the gen-tie and the Project fence line), the possibility that there are different carcass persistence rates inside and outside the Project fence line was accounted for. Twenty-nine trial carcasses within the Project (within solar arrays and along the fence line) and two trial carcasses along the gen-tie were monitored using motion-triggered digital trail cameras, while the remaining trial carcasses were visited on foot for 30 days or until the trial carcass had deteriorated to a condition at which it would no longer qualify as a documentable mortality. Trial carcasses without trail cameras were visited and photographed once per day for the first four days, and then every three to five days until the end of the monitoring period. To avoid training scavengers to recognize cameras as "feeding stations", trail cameras were installed five days before specimens were placed, and 16 fake cameras without bias trial carcasses were also placed within the Project fence line. Periodic ground-based checks of trial carcasses with trail cameras were also conducted to guard against misleading indicators of carcass removal such as wind blowing the trial carcass out of the camera's field of view. To minimize potential bias caused by scavenger swamping (Smallwood 2007, Smallwood et al. 2010), persistence trial carcasses were distributed across the entire Project, not just in areas subject to standard searches, and trials were initiated using fewer trial carcasses on two different dates throughout the fall season.

2.2.2 *Estimating Carcass Persistence Times*

Measurements of carcass persistence rates were subject to censoring. In this context, censoring refers to the instance when a value (e.g. days a carcass is present before being removed) may not be known exactly, but is known to be within a finite range. For example, if a carcass was present on day 7 but missing when checked on day 10, the exact time of removal is unknown. However, it is known that the carcass became unavailable at some point between 7 and 10 days. This carcass would be considered "interval censored". Similarly, if a carcass lasts the entire 30-day trial period, that carcass is "right censored"; as it is known that the carcass lasted at least 30 days, but may have persisted longer. Because carcass persistence data were censored, persistence was analyzed using methods that can accommodate censored data and still produce unbiased estimates of the probability of persistence (Therneau and Lumley 2015, Therneau and Grambsch 2000). It is beyond the scope of this document to provide statistical foundations of censored-data survival models, but functions identical to those provided with the USGS-developed fatality estimator software (Huso et al. 2015) were used to fit survival models to the censored carcass persistence data, and some background is available in the documentation provided with that software.

The USGS software used to estimate carcass persistence calculates the period over which there is less than a 1% chance for a carcass to persist. The "effective search interval' is defined as the shorter of: a) the length of time beyond which there is less than a 1% probability that a carcass persists, and b) the actual search interval (Huso 2011). The probability of persistence is given for the effective search interval, and the probability that a carcass persists through the actual search interval is equal to *p* (persist through effective search interval) * effective search interval / actual search interval.

There were four distributions implemented in the survival models used to estimate the probability that a trial carcass was unscavenged and available to be found at the end of the search interval (*r)*: exponential, Weibull, loglogistic, and lognormal. These four distributions exhibit varying degrees of flexibility in order to model a wide variety of distributions of persistence time. Akaike's Information Criterion adjusted for sample size (AICc; Akaike 1973) was used to rank the fit of each survival model with combinations of the covariates carcass size and season to the observed carcass persistence data. The AICc score provides a relative measure of model fit and parsimony among a selection of candidate models, and provides a framework for testing hypotheses regarding which factors contribute to carcass persistence rates. The model with the lowest AICc score is typically chosen as the "most supported" model relative to other models tested; however, any model within two AICc points of the most supported model was considered competitive with the most supported model (Burnham and

Anderson 2004). Carcass persistence trial from spring, summer, and fall were used to inform the carcass persistence models

2.3 Searcher Efficiency Trials

Searcher efficiency trials were conducted throughout the fall period. Trial carcasses from three size classes (small, medium, and large) were used for trials. Small carcasses were 2- to 3-week old Coturnix quail, medium-sized carcasses were adult Coturnix quail and adult northern bobwhite (*Colinus virginianus*), and large carcasses were female mallards and female ring-necked pheasants.

2.3.1 *Searcher Efficiency Data Collection*

To quantify searcher efficiency, 25 small trial carcasses, 15 medium, and 11 large were placed within the solar array, while 15 small, 10 medium, and 10 large trial carcasses were placed along the fence line, and 17 small, 10 medium, and 10 large trial carcasses were placed along the gen-tie sampling areas (pooled between Blythe and McCoy given the gen-tie is a shared feature). During the fall 2016 season, 123 searcher efficiency trials occurred at the Project.

Searcher efficiency trial carcasses were placed at random locations within the search areas prior to the actual search effort that same day by the biologist designated as the "experimenter." Prior to placement in the field by the experimenter, all trial carcasses were marked with an inconspicuous piece of black tape around the leg, so that they could be clearly identified as experimental trial carcasses, but not be visible as such from a distance. Trial carcasses were placed by dropping the carcasses from waist height or higher, in order to simulate natural positioning of fallen carcasses, and to avoid placement bias. A global positioning system (GPS) was used by the experimenter to record the location of each trial carcass placed. After the search effort was completed, the number and location of searcher efficiency trial carcasses found during the carcass survey were recorded. The number of trial carcasses available for detection during each trial was determined after the trial by the experimenter, who returned to the location of any undiscovered trial carcasses to document whether they were still available. Trial carcasses were collected either as they were detected by a searcher, or by the experimenter shortly after the search occurred, but always within a few hours of the completion of a search. It is possible that carcasses that were missed by a searcher were scavenged soon after the search was conducted, but before the experimenter returned to retrieve the trial carcass. However, this potential source of bias is minimal as collection occurs as soon after the search as possible within logistical constraints.

2.3.2 *Estimating Searcher Efficiency*

Searcher efficiency at the Project was estimated separately for linear features (the Project fence line and the gen-tie) and for the solar arrays, reflecting the different search methods used on arrays and linear features. For linear features, logistic regression models were fit to searcher efficiency data and AICc was used to compare models including the effects of carcass size (three classes). Model selection indicated that the most supported model included main effects of Project component and carcass size. Once the most supported model was chosen and appropriate classes identified, searcher efficiency, or the proportion of carcasses detected, *p*, was calculated for each class using the following equation:

$$\hat{p}_i = \frac{Number\ of\ Carcasses\ Found\ in\ catagory\ i}{Number\ of\ Carcasses\ Available\ in\ catagory\ i}$$

The data for this analysis included all searcher efficiency trial carcasses from the spring, summer, and fall 2016 seasons.

For the solar arrays, searcher efficiency was evaluated using a distance sampling approach (Buckland et al. 1993). Distance sampling assumes perfect detection on the transect line (at a distance equal to zero), an assumption that is likely valid in the solar arrays given the relatively flat and vegetation-free nature of the soil surface. A curve was fitted to the observed carcass data that predicted the probability of detection as a function of distance from the transect line. The mean value of this function over a specified distance, *w,* is equal to the average searcher efficiency for a transect of width *w*. The mean value of the detection curve is the integral of the detection function calculated between zero m and the maximum survey distance (*w;* half the width of the solar array row), divided by the maximum survey distance:

$$p = \frac{\int_0^w f(x)dx}{w}$$

where *f(x)* is the detection function evaluated at distance, *x*.

One departure in the methods used here, relative to the methods presented in Buckland et al. (1993), was that the detection function was estimated using trial carcasses for this study, which meant that there were both presence (detected) and absence (not detected) data available to fit the detection function. The availability of both presence and absence data means that the detection function can be estimated using only trial carcasses whose distribution is known. Therefore, the detection function, the average searcher efficiency among the arrays, and the final fatality estimate within the arrays are all insensitive to the spatial distribution of carcasses within individual arrays, and the overall searcher efficiency estimate is valid even if the distribution of carcasses among the arrays is not uniform.

Distances of trial carcasses (carcasses both found and missed) from the transect line were used to fit half-normal, exponential, uniform, and hazard rate distribution detection functions for searches among the arrays, which are all commonly used functions for distance sampling surveys (Buckland et al. 1993). Searcher efficiency was modeled separately for small, medium, and large birds. The fit of detection functions were compared using AICc. The most supported detection function for small and medium birds had an exponential distribution. The most supported detection function for large birds had a half-normal distribution. Given that gen-tie data were pooled between the McCoy and Blythe projects, gen-tie data were modeled separately from the fence line component. A model with a size effect was chosen for both the fence line and gen-tie component.

Because the solar arrays were surveyed by a searcher who drove down one side of the rows of panels, the width of the search transect was specified as the width of the rows of panels. For larger birds, there is almost certainly a non-zero detection probability beyond this distance, but the bias that occurs by ignoring this non-zero detection probability is conservative (i.e. the searcher efficiency is underestimated).

2.4 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 that lead 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 the gen-tie versus cleared areas beneath solar panels). For these reasons, it is generally inappropriate to draw conclusions based on the raw number of detections alone. The desire to estimate the number of fatalities given these variables has driven the development of several statistical methods for estimating numbers of fatalities (e.g., Smallwood 2007, Huso 2011, Korner-Nievergelt et al. 2011). All of these fatality estimation methods share a similar underlying model based on a Horvitz-Thompson type estimator (Horvitz and Thompson 1952). Generally, the fatality estimate for a sample of a given site may be written as:

$$\hat{F} = C/\hat{r}\hat{p}a$$

where $\hat{F}$ is the total number of fatalities, *C* is the number of detections found and included in fatality estimation, $\hat{r}$ is the probability a carcass is unscavenged and available to be found at the end of the search interval, $\hat{p}$ is the probability of detecting a carcass, and a is the proportion of area searched (see Table 2 for proportion of area searched for each component; Huso 2011). The binomial carcass detection model was used to calculate fatality estimates at the Project fence line and gen-tie, and the average probability of detection based on distance sampling (described previously) was used to estimate probability of detection within the solar arrays.

All fatality estimates were calculated using the Huso estimator (modified to accommodate the distance-sampling based estimate of searcher efficiency in the solar arrays), as well as 90% confidence intervals (CIs) using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and CIs for complicated test statistics. A total of 1,000 bootstrap replicates were used for each variable, including searcher efficiency (*p*), probability of a carcass persisting to the next search ($\hat{r}$), adjusted search interval, and observed number of detections. From these bootstrap samples, the probability of a carcass being available and detected was calculated and applied to the bootstrapped observed number of fatalities. The lower 5^{th} and upper 95^{th} percentiles of the 1,000 bootstrap estimates provide estimates of the lower limit and upper limit of an approximate 90% CI on all estimates. In some instances, the lower limit was not viable (i.e., zero) based on actual presence of carcasses in the sampled areas, so the actual number found was assumed to be the lower limit. This is identified in the text and Appendix E by a *[#]* character, where *[#]* represents the actual number found used to inform the analysis.

Horvitz-Thompson estimators, such as the Huso estimator used to estimate fatality at solar-energy facilities, become unstable when carcass counts are low (Korner-Nievergelt et. al 2011). Precision for fatality estimates decreases rapidly as the number of carcasses found during standardized carcass searches decreases (Korner-Nievergelt et. al 2011). Confidence intervals calculated when carcass counts are low can be very wide and unreliable.

2.5 Incidental Reporting

Some detections were recorded outside standardized search areas, or were within search areas but were not found during standardized searches. Such detections were found by WEST avian biologist and operations personnel and were considered "incidental" detections. When found by operations personnel, these detections were reported to WEST avian biologists for documentation. Data on incidental detections are reported here, as well as in the Project Special Purpose Utility (SPUT) Avian Injury and Mortality Report Forms. All detections made in search areas during the reporting period were included in fatality estimates, regardless of whether they were detected incidentally or during searches.

3.0 MONITORING RESULTS

3.1 Summary of Avian Detections

During fall 2016, a total of 33 avian detections (including incidental detections) of 17 identified species were recorded in the Project (Table 3). Of these 33 detections, five were unidentified and two could only be identified to guild (sparrow and warbler). The most common species were Savannah sparrow (*Passerculus sandwichensis*) with five detections and white-crowned sparrow (*Zonotrichia leucophrys*) with three detections. All other species were represented by two or fewer detections. Most detections (26 detections or 78.8% of the total detections) occurred along the gen-tie (Figure 3; Tables 3, 4, and 5). Four detections (12.1%) occurred along the fence line and three detections occurred at other project infrastructure (two along roads and one at a parking lot). Twenty-two (66.7%) of the 33 detections occurred during standardized carcass searches, and the remaining 11 (33.3%) were documented as incidental detections. No live injured or stranded birds were found during the fall period. No bats were detected during the fall season. A detailed map of detections within the solar arrays and along the fence line is presented in Appendix B. For fresh carcasses, body weights and weather conditions for the preceding nights are presented in Appendix C. A summary of all avian guilds, migration behavior, four-letter species codes, scientific names, and sizes represented by detections found during fall 2016 can be found in Appendix D

An additional 14 detections occurred along the McCoy gen-tie sections, of which 10 small birds and one medium bird occurred in sample units. The BBCS assumes gen-tie detection data will be pooled between the two facilities and a single fatality estimate will be produced. The detection data presented below are specific to the Blythe Project (including the Project gen-tie sample units), unless noted otherwise. For details on the McCoy specific detections, please see the McCoy fall report (WEST 2018).

Table 3. Number of individual bird detections, by species, found during scheduled searches and incidentally during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California.

Common Name	Solar Array	Fence Line	Gen-Tie	Other	Total
black-throated gray warbler	0	0	1	0	1
Brewer's sparrow	0	0	1	0	1
cattle egret	0	0	0	1	1
green-tailed towhee	0	0	1	0	1
horned lark	0	0	1	0	1
house wren	0	1	0	0	1
Lincoln's sparrow	0	0	1	1	2
MacGillivray's warbler	0	0	1	0	1
mourning dove	0	1	0	0	1
orange-crowned warbler	0	0	2	0	2
rock pigeon	0	0	1	0	1
rock wren	0	0	1	0	1
ruby-crowned kinglet	0	0	1	0	1
savannah sparrow	0	1	4	0	5
snowy plover	0	0	0	1	1
white-crowned sparrow	0	0	3	0	3
Wilson's warbler	0	0	2	0	2
unidentified bird (small)	0	0	5	0	5
unidentified sparrow	0	1	0	0	1
unidentified warbler	0	0	1	0	1
Total	**0**	**4**	**26**	**3**	**33**

Table 4. Total avian detections by Project component and detection category during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California. Only carcasses found within search areas were included in fatality estimates.

	Inside Carcass Search Area		Outside Carcass Search Area	
Project Component	**Carcass Search**	**Incidental**	**Carcass Search**	**Incidental**
Fence line	3	1	0	0
Gen-tie	19	1	0	6
Solar arrays	0	0	0	0
Other	0	0	0	3
Total	**22**	**2**	**0**	**9**

Table 5. Total avian detections (including incidental detections) by Project component and suspected cause of death during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California.

	Suspected Cause of Death*			
Project Component	**Collision**	**Electrocuted**	**Unknown**	**Percent of Total**
Fence line	3	0	1	**12.1**
Gen-tie	15	0	11	**78.8**
Solar arrays	0	0	0	**0**
Other	1	1	1	**9.0**
Percent of Total	**57.6**	**3.0**	**39.4**	**100**

*Suspected cause of death or injury was assigned based on evidence available from the detection, evidence available on Project infrastructure, and proximity of the detection to Project infrastructure. Detections that had evidence of scavenging and lacked evidence on Project infrastructure were assigned “unknown” cause of death. Detections that were relatively intact (i.e., with minimal evidence of scavenging) and located in close proximity to Project infrastructure (e.g., found directly beneath overhead lines) had a suspected cause of death attributed to the respective Project component. However, it should be noted that there is uncertainty associated with cause of death assignments because no events were directly observed.

3.2 Temporal Patterns of Avian Detections

The number of detections recorded daily during the reporting period ranged from zero to five (Figure 5). Detections were fairly consistent across the fall period. Daily detections peaked on October 6, 2016. The number of detections per day represents those discovered during standardized carcass searches and incidentally.

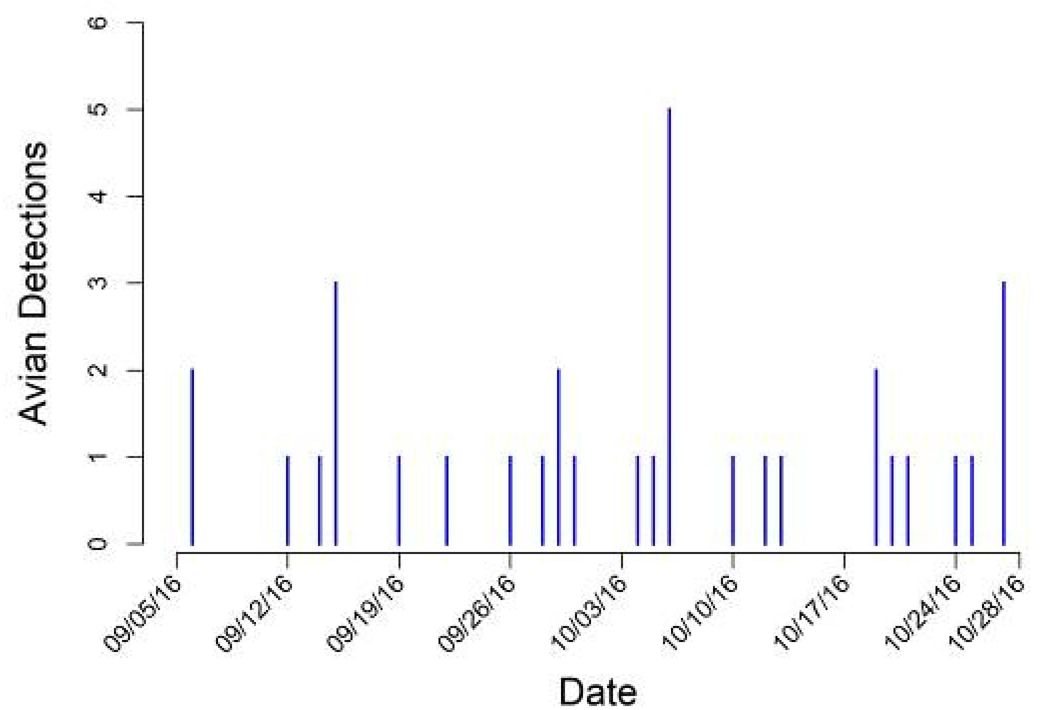

Figure 5. Total count of detections (including incidental detections) by date during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California.

3.3 Spatial Distribution of Avian Detections

3.3.1 *Detections by Project Component*

During the reporting period, detections were documented near the gen-tie, fence line, and at other project infrastructure (Tables 3, 4, and 5). Twenty-six detections occurred along the Project gen-tie sample units, four occurred along the fence line, and three occurred at other project infrastructure (site access road, parking lot). Two of the detections located at other project infrastructure occurred near the solar arrays, but were outside of the search area (greater than 10 meters from an array) under overhead lines.

3.3.2 *Feather Spot or Partial Detections*

Eight (24.2%) of the 33 detections documented during the fall survey period were partial bird carcasses (e.g., wing) and four (12.1%) detections were feather spots. This resulted in five unidentified detections classified as small birds, and two detections classified to guild (one warbler and one sparrow).

3.4 Detections of Injured or Stranded Birds

No detections of injured or stranded birds occurred during the fall period at the Project.

3.5 Summary of Bat Detections

No bats were detected during the fall 2016 season.

3.6 Carcass Persistence Trials

A total of 110 carcass persistence trial carcasses were placed at the solar array and gen-tie during fall 2016. Models were fitted separately for each size class for relative quality using the corrected AICc score, as suggested in Huso (2011). The AICc score provides a relative measure of model fit and parsimony among a selection of candidate models, and provides a framework for testing hypotheses regarding which factors contribute to carcass persistence rates. Modeling was split between project components due to the Blythe and McCoy gen-tie being pooled between the two projects. Additionally, all trial data from the spring and summer periods were used to further inform the models.

The model with the lowest AICc score is typically chosen as the “most supported” model relative to other models tested; however, any model within two AICc points of the most supported model is considered competitive with the most supported model (Burnham and Anderson 2004). The most supported model for all birds, modeled separately for each size class and location (solar field or gen-tie), was an intercept-only model. The best model for large birds in the solar array was an exponential distribution, while large birds along the gen-tie followed a Weibull distribution. The best models for medium and small birds in the arrays followed a lognormal distribution as did small birds along the gen-tie. The best model for medium birds along the gen-tie followed a loglogistic distribution. All gen-tie estimates include pooled carcass persistence trial data from Blythe and McCoy. Estimates of carcass removal time and persistence probabilities from the most supported model are reported in Table 6, and estimates of proportion of carcasses remaining as a function of days since carcass placement are provided in Figure 6. Detailed estimates of carcass removal and associated CIs are provided in Appendix E.

Carcass persistence was influenced by carcass size and Project component. Small carcasses in the solar arrays and along the fence (combined) had a 61.1% chance (90% CI: 55 – 67%) of persisting through the effective search interval, medium carcasses had a 68.1% (90% CI: 60 – 76%) chance, and large carcasses had a 95.5% (90% CI: 93 – 98%) chance. Median removal times within the arrays for small, medium, and large trial carcasses were 4.6, 7.0, and 51.7 days, respectively. Along the gen-tie (pooled data for Blythe and McCoy), chances of persistence for small, medium, and large carcasses were 26.7% (90% CI: 21 – 32%), 35.0% (90% CI: 26 – 44%), and 47.4% (90% CI: 35 – 58%) respectively; median removal times for small, medium, and large carcasses were 1.1, 1.3, and 2.5 days, respectively.

Removal times were shorter for gen-tie components when compared to solar array and fence line components. The probability of persistence was greater than 60% for small and medium bird trial carcasses and greater than 95% for large bird trial carcasses inside the Project fence.

Along the gen-tie, all size classes had less than 50% probability of persistence through the effective search interval.

Table 6. Median carcass removal time and probability of a carcass persisting through the effective search interval during the fall 2016 (September 4 – October 29) season at the Blythe Solar Power Project, Riverside County, California.

Carcass Size	Project Component*	Median Removal Time (Days)	Probability of Persistence (%)
Small	Arrays/fence line	4.6	61.1
Small	Gen-tie	1.1	26.7
Medium	Arrays/fence line	7.0	68.1
Medium	Gen-tie	1.3	35.0
Large	Arrays/fence line	51.7	95.5
Large	Gen-tie	2.5	47.4

*Gen-tie data includes pooled data from Blythe and McCoy

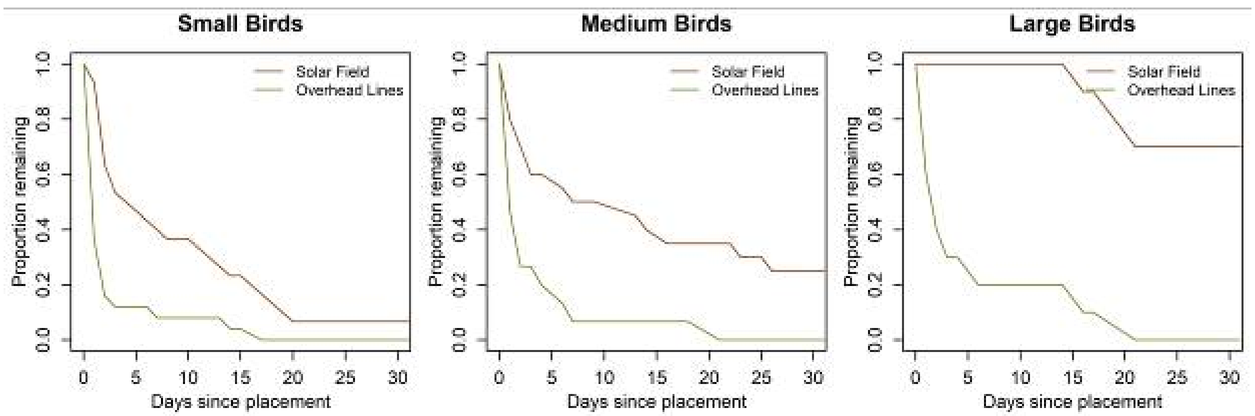

Figure 6. Proportion of trial carcasses remaining as a function of days since placement and carcass size class during the fall 2016 (September 4 – October 29) monitoring season at the Blythe Solar Power Project, Riverside County, California. These data include spring, summer, and fall 2016 trial data; 90 small, 60 medium, and 30 large birds were placed in the solar field; 75 small, 45 medium, and 30 large birds were placed along the gen-tie. Gen-tie data were pooled between Blythe and McCoy.

3.7 Searcher Efficiency Trials

During the reporting period, 123 searcher efficiency trial carcasses were placed at the Project. Most trials were available to be found, but some disappeared before the survey occurred. It is likely that these trials were scavenged. Overall, 51 trials were placed in the solar arrays and 48 were available to be found; 35 trials were placed along the fence line (inner perimeter only) and 30 were available to be found; and 37 trials were placed along the gen-tie and 31 were available to be found. All available trials were included in estimation of searcher efficiency. Gen-tie trial data were pooled for the Blythe and McCoy Projects.

For trials placed in the solar arrays, searcher efficiency was modeled separately for small, medium, and large bird trial carcasses. The best model for small and medium carcass sizes was an exponential distribution. The best model for large carcass sizes was a half-normal distribution. Within the solar arrays, searcher efficiency was: 87.8% (90% CI: 78-97%) for large bird trial carcasses; 47.7% (90% CI: 35-61%) for medium bird trial carcasses; and 47.3% (90 CI: 40-56%) for small bird trial carcasses (Figure 7; Appendix E).

For linear Project components, the distance sampling approach was not implemented; therefore, searcher efficiency rates were calculated based on the number available and number found along the fence line and gen-tie. Along the fence line, searcher efficiency was 92.1% (90% CI: 84-100%) for small bird trial carcasses, and 100% (no CI) for both medium and large bird trial carcasses. Along the gen-tie, searcher efficiency was 81.1% (90% CI: 70-92%) for small bird trial carcasses, 92.0% (90% CI: 80-100%) for medium bird trial carcasses, and 100% (no CI) for large bird trial carcasses. The gen-tie included pooled trial data for both the Blythe and McCoy Projects. Detailed estimates of searcher efficiency specific to each component and carcass size are reported in Appendix E.

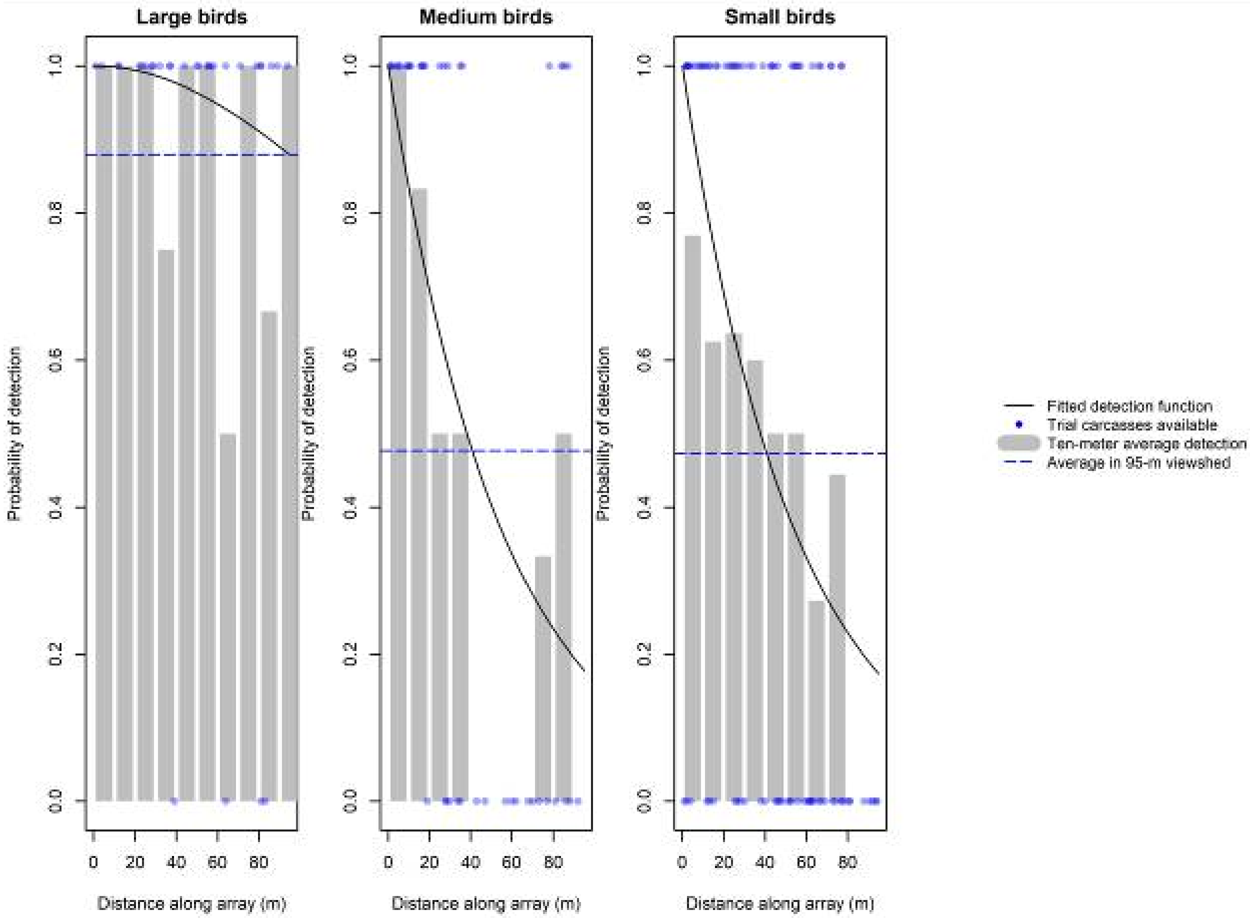

Figure 7. Estimated detection probabilities for bird carcasses by size class during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California. Distance sampling was used when searching solar arrays only. Average probability of detection at 95-m panel rows in solar arrays are presented. Estimates are informed by 96, 45 and 33 small, medium and large bird carcass trials, respectively conducted in spring, summer, and fall trials.

3.8 Fatality Estimates

Fatality estimates were calculated separately for each component (solar arrays, fence line, and gen-tie). Gen-tie estimates include pooled data from the Blythe and McCoy Projects. Ultimately, two detections were excluded from the solar array fatality analysis because they were found outside of standardized search areas, one detection found on the Project access road was excluded from all fatality analysis, and nine detections were excluded from the Blythe and McCoy gen-tie fatality analysis because they were found outside of the standardized gen-tie sample units. All 33 detections that were documented at the Project (including the Project gen-tie sections) during fall are reported in Table 3.

No fatality estimate was produced for the solar arrays during the fall 2016 monitoring, as no detections occurred in the sample units during standard searches. However, two incidental detections did occur near the non-searched solar array area, but were greater than 10 m from a solar panel. The adjusted fatality estimate for fall along the fence line was modeled at approximately six small bird fatalities (90% CI: *[3]* - 12) and approximately two medium bird fatalities (90% CI: *[1]* - 5). No large bird detections occurred along the fence line. The total fence line fatality estimate was approximately nine birds (90% CI: *[4]* – 17). These estimates are based on three small bird and one medium bird detections along the fence.

Gen-tie fatality estimates were informed by pooling the Blythe and McCoy Project data. The adjusted fatality estimate along the entire gen-tie was 284 small bird fatalities (90% CI: 188 – 403) and approximately six medium bird fatalities (90% CI: *[1]* – 20). These estimates are based on 30 small bird detections and one medium bird detection in the sample units. No large bird detections occurred along the gen-tie in the fall, therefore, no fatality estimate was modeled. Assuming each project is responsible for half of the gen-tie, an estimate for the Blythe Project gen-tie would be 142 small bird fatalities and three medium bird fatalities for a total of 145 bird fatalities. Estimates of fatalities along the gen-tie were heavily influenced by the high rates of scavenging observed during the limited trials at the gen-tie (i.e., large correction factors) producing greater uncertainty in the estimate and a wide confidence interval. A complete list of estimates for each Project component and carcass size class with CIs is presented in Appendix E.

4.0 DISCUSSION

The 2016 fall season represented the third season of standardized Year 1 monitoring at the Project. Searcher efficiency and carcass persistence trials were conducted concurrently at the solar arrays, fence line, and along the gen-tie. Data from these trials were used to produce fatality estimates adjusted for searcher efficiency and carcass persistence bias. These results should be considered preliminary because carcass persistence, searcher efficiency, and adjusted numbers of fatalities were informed by less than a full year of data. As more surveys are completed, the estimates will be informed by more data and a higher level of confidence can be derived from the models. As more data are collected throughout the monitoring year (and additional quality assurance/quality control measures occur), data from all seasons may be pooled. At that time, data will be tested for seasonal differences retrospectively, but because seasonal estimates will be produced from the much larger annual data set, they may differ from what is reported here because they are based on a larger, more informative sample.

It is also worth noting that the Project is not fully constructed and operational; therefore, sampled areas do not fully represent those proposed in the BBCS once the facility is operational. Sample units in Block 6 had less survey events due to a later turn-over date. Block 7 was not turned over, so it was not sampled. It is anticipated that all blocks will be turned over for the winter season and the full Year-2 study period. Results from the Year-1 study period will help identify potential Project related impacts; however, due to the staggered search efforts across all Year-1 seasons some discrepancies may exist. Year-2 will likely provide the most confident data and analysis, as the entire site will be operational and all sample units will be searched an equal number of times.

4.1 Carcass Persistence and Searcher Efficiency Trials

The degree to which carcasses persist on the landscape depends on a variety of factors reflecting seasonal and inter-annual variation in habitat, climate, and the scavenger community. The composition and activity patterns of the scavenger community often vary seasonally as bird scavengers migrate, new juvenile birds and mammalian scavengers join the local population, and mammalian scavengers variably hibernate or estivate. The scavenger community may also vary substantially from year to year because of variation in annual reproduction and survival related to changes in landscape condition. Climatic conditions that vary seasonally and annually also may contribute to variation in carcass decay and removal rates due to variation in temperatures, solar insolation, wind patterns, and the frequency of flooding events. Thus, rates of carcass persistence reported here should be interpreted cautiously as they may change over the coming months.

Fatality estimates are influenced by the relationship between carcass removal dynamics and search intervals. In practical terms, longer search intervals reduce the average probability that a carcass persists until the next search. In terms of the analysis, this can manifest as a lower probability of persistence through the effective search interval, or an effective search interval that is shorter than the nominal search interval. In either case, the adjustment to carcass counts due to carcass removal dynamics is calculated as:

$$\frac{length\ of\ effective\ search\ interval}{length\ of\ nominal\ search\ interval * average\ probability\ of\ persistence\ through\ the\ effective\ search\ interval}$$

The adjustment to estimated fatality for carcass removal increases with longer search intervals, and the variance in the estimate may also increase.

Carcass persistence at the Project is clearly influenced by whether a carcass is located in the solar field (inside the fence line) or along the gen-tie (outside the fence line), with shorter removal rates occurring along the gen-tie. Although the same scavenger species may occur at both locations, a difference in scavenger density or activity could possibly be responsible for the different rates of carcass persistence. The fence line likely provides a barrier to scavengers and general site operational activity (specifically construction related activity) likely affects scavenger presence. If there are differences in scavenging rates between the trial carcasses and naturally-occurring carcasses, it is possible that the high scavenging rates observed along the gen-tie have resulted in inflated fatality estimates. This hypothesis may be evaluated in the annual report by comparing persistence rates of trial carcasses to the age of carcasses detected by observers. Given the very high scavenging rates along the gen-tie, fatality estimates for the gen-tie may have greater uncertainty (i.e. wider confidence intervals) along that Project component.

Searcher efficiency rates within the solar arrays were moderate for small and medium birds (just under 50%) and high for large birds (~88%). The high rate observed for large birds was likely influenced by the limited vegetation cover beneath solar panels. The sample area may have a greater effect on the searcher efficiency rates, as the gen-tie has a sample area width of 30 m and the fence line has sample area width of six meters. Conversely, the solar array has viewsheds extending up to 95 m. A much higher searcher efficiency rate was observed along the gen-tie and fence line across all bird carcass size classes.

4.2 Distribution of Fatalities and Fatality Estimates

Detections were distributed throughout the fall season, with early October having the greatest number of detections. No obvious temporal trend was identified for fall detections based on the collected data; however, more detections did occur in fall when compared with the 2016 spring (16 detections) and summer (12 detections) seasons. Survey methods did vary among the seasons with different search intervals and units sampled (due to block turn-over dates).

Most (78.8%) of the 33 detections recorded during fall were along the gen-tie. Four detections occurred along the fence line and three detections occurred at other project infrastructure. In summer 2016, the number of detections were roughly equivalent between the gen-tie (four detections) and the solar array (three detections), while in spring 2016 detections occurred more frequently along the gen-tie (10 detections) when compared with the solar array (one detection). Based on surveys completed and data collected to date, the lowest number of detections has occurred in the solar arrays and the highest number of detections has occurred along the gen-tie.

Detections attributed to an unknown cause accounted for 39.4% of all detections during the reporting period. Collision was suspected as the cause of death for 57.6% of detections. One detection (3.0%) was attributed to electrocution. Twelve (36.4%) detections were partial carcasses (e.g., broken up or feather spot), and therefore a cause of death could not be determined. Additionally, one carcass was intact, but had been run over, so a cause of death could not be determined. Determining the cause of death for many of the detections was difficult due to the presence of one or more project components in or near the sample units. Overhead lines often parallel the fence line and roadways often parallel the gen-tie. For this report, we conservatively associated any detection found in a sample area with that project component. An example would be a detection found on a road within the gen-tie sample area. Regardless of whether the fatality resulted from a vehicle impact, the carcass was documented as a gen-tie detection. Six detections recorded in the fall were located near more than one project component.

Composition of detections during fall 2016 included seven avian guilds. Grassland birds and sparrows composed the majority of detections (14 detections), followed by warblers (seven detections). All other guilds were represented by one or two detections. Two water-associated birds (cattle egret and snowy plover) were detected inside the fence line, with one occurring under an overhead line near the substation and one detected on a road in the solar array under an overhead line. Species that migrate nocturnally were detected most frequently during fall (20 detections). Four detections of resident birds and one detection of diurnally/nocturnally migrating species were also identified.

No fatality estimate was produced for the solar array during the fall 2016 monitoring, as no detections occurred in the sample units during standard searches. However, two incidental detections did occur near the solar arrays, but were greater than 10 m from a solar panel.

The adjusted fatality estimate for fall 2016 along the fence line was modeled at approximately six small bird fatalities (90% CI: *[3]* –12) and approximately two medium bird fatalities (90% CI: *[1]* – 5). The adjusted fatality estimate for fall 2016 along the gen-tie was modeled at approximately 284 small birds fatalities (90% CI: 188 – 403) and six medium bird fatalities *(90% CI: [1]* - 20).

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Appendix A. Detailed Areas of Detection Locations along the Gen-Tie of the Blythe Solar Power Project during Fall 2016 (September 4 – October 29) Monitoring

Appendix A-1. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

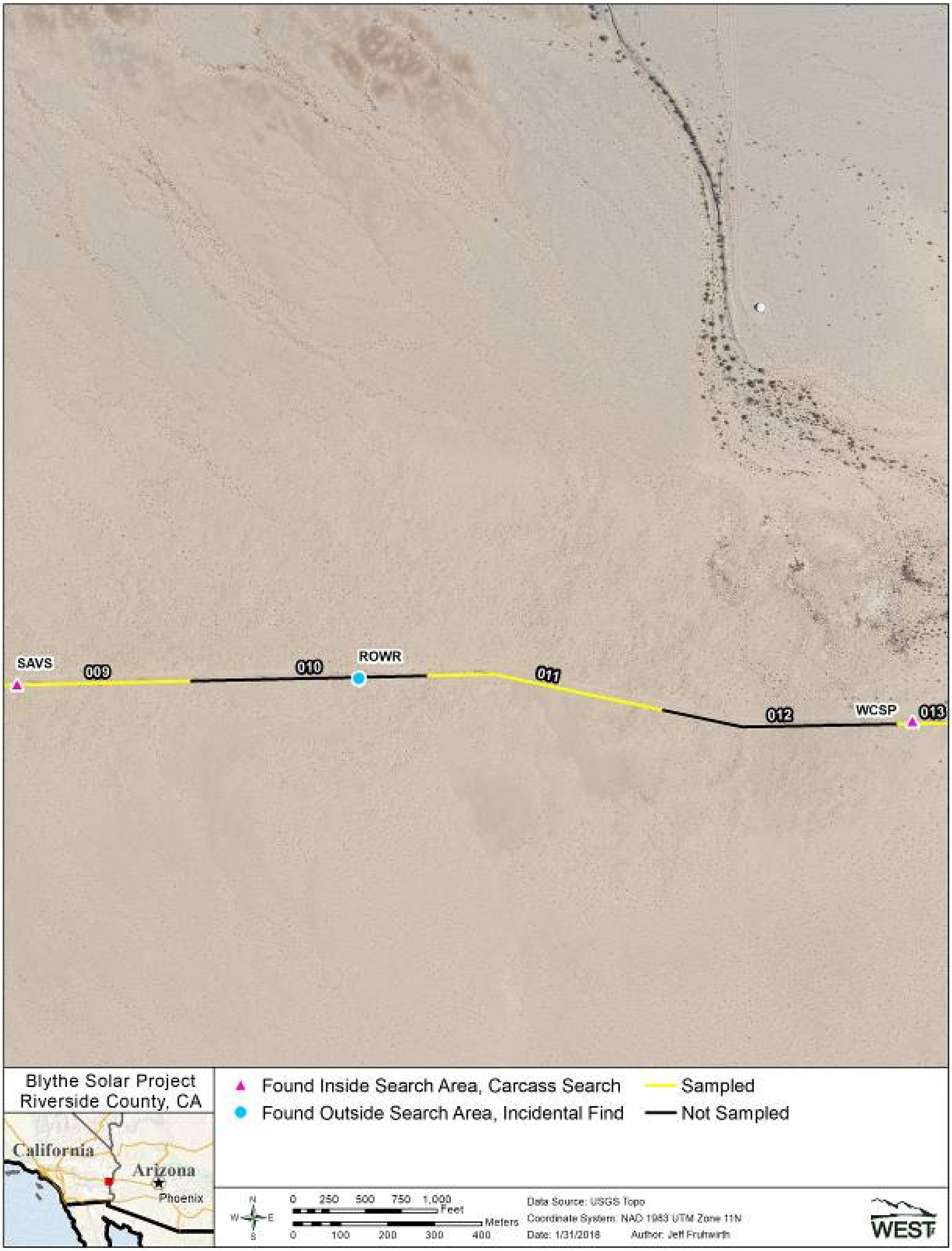
Appendix A-2. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-3. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-4. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-5. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-6. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

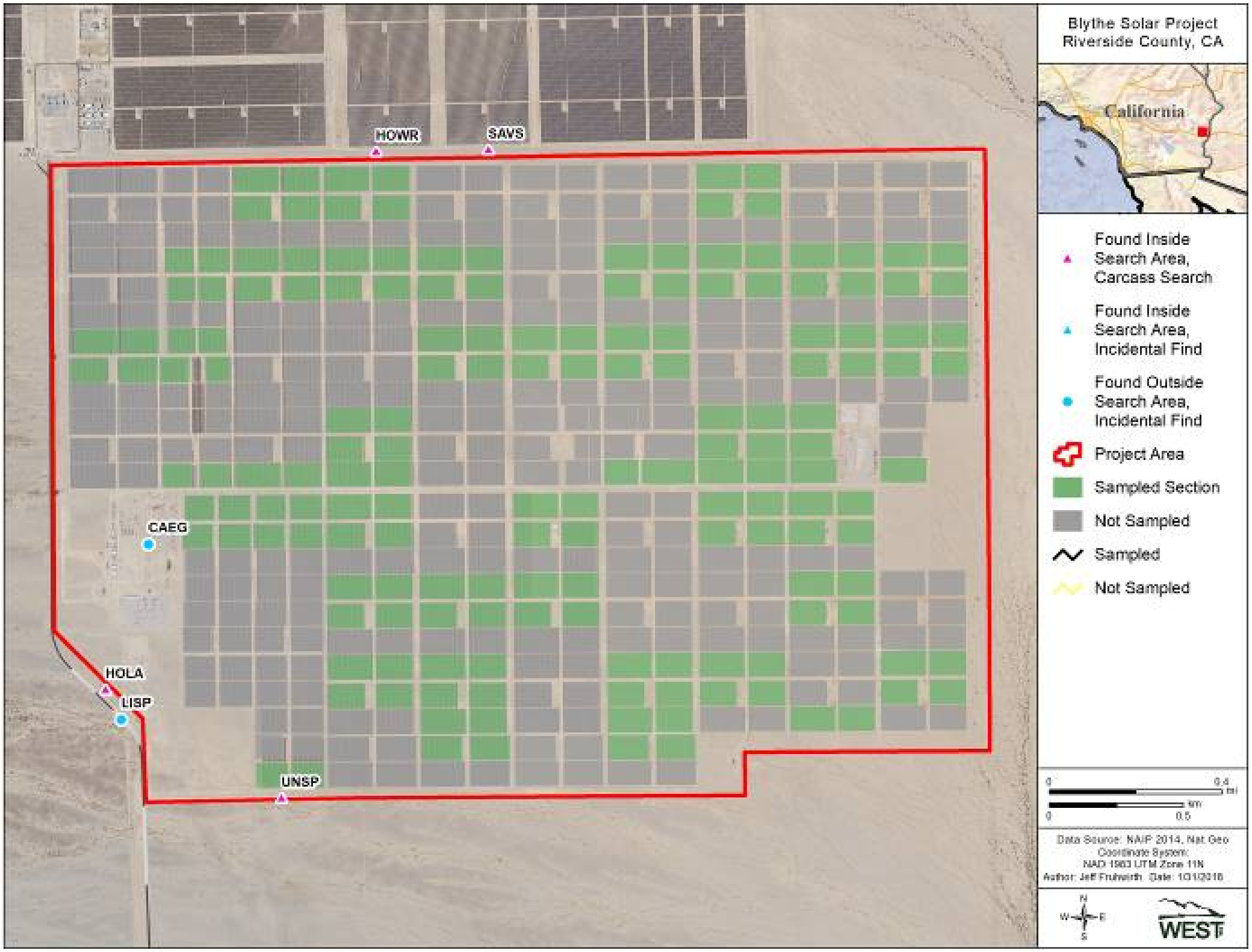


Appendix A-7. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-8. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix A-9. Detailed map of detection locations along the gen-tie at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix B. Detailed Areas of Detection Locations within the Solar Arrays and along the Fence Line of the Blythe Solar Power Project during Fall 2016 (September 4 – October 29) Monitoring



Appendix B. Detailed map of detection locations along the solar arrays and fence line at the Blythe Solar Power Project during fall 2016 (September 4 – October 29) monitoring.

Appendix C. Weather Conditions and Body Weights Associated with Avian Detections Estimated to be Less Than 24 Hours Old during Fall 2016 (September 4 – October 29) Monitoring at the Blythe Solar Power Project

Appendix C. Weather conditions and body weights associated with detections estimated to be less than 24 hours old during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California.

Carcass ID	Date	Estimated time since death (hrs)	Species	Weight (g)[1]	Weather	Wind Direction	Wind Speed Avg.	Wind Speed Maximum
090616-JKP-01	9/6/2016	0-8h	mourning dove	105	Clear	N	1	4
090616-JKP-02	9/6/2016	0-8h	snowy plover	NA	Clear	N	1	4
091216-AKW-01	9/12/2016	0-8h	green-tailed towhee	23	Unknown	NA	NA	NA
091516-AKW-01	9/15/2016	8-24h	Savannah sparrow	16	Clear	W	1	3
091516-AKW-02	9/15/2016	8-24h	Wilson's warbler	6	Clear	W	1	3
091516-AKW-03	9/15/2016	8-24h	MacGillivray's warbler	11	Clear	W	1	3
091916-JKP-01	9/19/2016	8-24h	Brewer's sparrow	17	Clear	W	2	5
092616-JKP-02	9/26/2016	0-8h	house wren	9	Wind	N	2	6
092816-JKP-01	9/28/2016	0-8h	Lincoln's sparrow	17	Clear	NA	0	0
100516-JKP-01	10/5/2016	0-8h	cattle egret	NA	Clear	S	1	4
100616-JKP-01	10/6/2016	0-8h	orange-crowned warbler	8	Clear	W	3	5
100616-JKP-03	10/6/2016	0-8h	white-crowned sparrow	22	Clear	NW	3	5
100616-JKP-04	10/6/2016	0-8h	vesper sparrow	20	Clear	NW	3	5
100616-JKP-05	10/6/2016	0-8h	rock wren	16	Clear	NW	3	5
101216-AKW-03	10/12/2016	8-24h	horned lark	NA	Clear	N	0	1
101316-AKW-01	10/13/2016	8-24h	white-crowned sparrow	22	Clear	W	0	1
101916-SN-02	10/19/2016	8-24h	Lincoln's sparrow	14	Clear	NW	7	12
102016-JKP-01	10/20/2016	0-8h	white-crowned sparrow	24	Wind	N	8	10
102116-JKP-01	10/21/2016	8-24h	unidentified bird (small)	NA	Clear	S	3	7
102416-AKW-01	10/24/2016	0-8h	black-throated gray warbler	7	Clear	W	2	3
102516-AKW-01	10/25/2016	8-24h	Savannah sparrow	20	Raining	E	1	12
102716-AKW-01	10/27/2016	8-24h	ruby-crowned kinglet	NA	Clear	SW	1	2
102716-AKW-03	10/27/2016	0-8h	Savannah sparrow	16	Clear	SW	1	2

[1] Weight recorded only for intact carcasses with no evidence of scavenging.

Appendix D. Guild, Migration Behavior, Four-Letter Species Codes, Scientific Names, and Sizes for All Avian Detections Made during Standardized Carcass Searches and Incidentally, by Species, during Fall 2016 (September 4 – October 29) Monitoring at the Blythe Solar Power Project

Table D. Guild, Migration Behavior, Four-Letter Species Codes, Scientific Names, and Sizes for all avian detections (those made during standardized carcass searches and incidentally) during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California. LB = large sized bird; MB = medium sized bird; SB = small sized bird

Common Name	4-Letter Species Code	Scientific Name	Guild	Migration Behavior*	Size
black-throated gray warbler	BTYW	*Setophaga nigrescens*	Warblers	nocturnal	SB
Brewer's sparrow	BRSP	*Spizella breweri*	Grassland/Sparrows	nocturnal	SB
cattle egret	CAEG	*Bubulcus ibis*	Waterbirds	resident	MB
green-tailed towhee	GTTO	*Pipilo chlorurus*	Grassland/Sparrows	resident	SB
horned lark	HOLA	*Eremophila alpestris*	Grassland/Sparrows	resident	SB
house wren	HOWR	*Troglodytes aedon*	Wrens	nocturnal	SB
Lincoln's sparrow	LISP	*Melospiza lincolnii*	Grassland/Sparrows	nocturnal	SB
MacGillivray's warbler	MGWA	*Geothlypis tolmiei*	Warblers	nocturnal	SB
mourning dove	MODO	*Zenaida macroura*	Doves/Pigeons	diurnal/nocturnal	MB
orange-crowned warbler	OCWA	*Oreothlypis celata*	Warblers	nocturnal	SB
rock pigeon	ROPI	*Columba livia*	Doves/Pigeons	resident	MB
rock wren	ROWR	*Salpinctes obsoletus*	Wrens	nocturnal	SB
ruby-crowned kinglet	RCKI	*Regulus calendula*	Gnatchatchers/Kinglet	nocturnal	SB
Savannah sparrow	SAVS	*Passerculus sandwichensis*	Grassland/Sparrows	nocturnal	SB
snowy plover	SNPL	*Charadrius nivosus*	Shorebirds	unknown	SB
vesper sparrow	VESP	*Pooecetes gramineus*	Grassland/Sparrows	nocturnal	SB

Table D. Guild, Migration Behavior, Four-Letter Species Codes, Scientific Names, and Sizes for all avian detections (those made during standardized carcass searches and incidentally) during fall 2016 (September 4 – October 29) monitoring at the Blythe Solar Power Project, Riverside County, California. LB = large sized bird; MB = medium sized bird; SB = small sized bird

Common Name	4-Letter Species Code	Scientific Name	Guild	Migration Behavior*	Size
white-crowned sparrow	WCSP	*Zonotrichia leucophrys*	Grassland/Sparrows	nocturnal	SB
Wilson's warbler	WIWA	*Cardellina pusilla*	Warblers	nocturnal	SB
unidentified bird (small)	UNID	NA	Unidentified small bird	NA	SB
unidentified sparrow	UNSP	NA	Grassland/Sparrows	NA	SB
unidentified warbler	UNWA	NA	Warblers	NA	SB

*See literature cited for bird migration behavior references; information for most bird species was taken from the respective species accounts found in Birds of North America Online (BNA 2016 [Ammon 1995; Ammon and Gilbert 1999; Chilton et al. 1995; Conway 1995; Gilbert et al. 2010; Hughes 2011; Johnson et al. 2002; Ortega and Hill 2010; Rotenberry et al. 1999; Schwertner et al. 2002]); where information on migration behavior was lacking in BNA accounts, Newton (2008) or Murray (2004) was used.

Appendix E. Correction Factors and Bird Fatality Rates at the Blythe Solar Power Project During Fall 2016 (September 4 – October 29) Monitoring

Appendix E-1. Correction factors and bird fatality rates at the Blythe Solar Power Project during fall 2016 (Sept 5 – November) monitoring.

	Small Birds		Medium Birds		Large Birds	
Parameter	**Mean**	**90% CI**	**Mean**	**90% CI**	**Mean**	**90% CI**
Proportion of Area Searched						
Solar arrays	0.41	-	0.41	-	0.41	-
Fence line	0.92	-	0.92	-	0.92	-
Gen-tie	0.49	-	0.49	-	0.49	-
Searcher Efficiency (no variance - all large birds at the fence line and gen-tie line were found)						
Solar array	0.47	0.40 – 0.56	0.48	0.35 – 0.61	0.88	0.78 – 0.97
Fence line	0.92	0.84 – 1	1	-	1	-
Gen-tie	0.81	0.70 – 0.92	0.92	0.80 – 1	1	-
Average Probability of Carcass Persistence through the Effective Search Interval						
Solar arrays and fence line	0.61	0.55 – 0.67	0.68	0.61 – 0.76	0.96	0.93 – 0.98
Gen-tie	0.27	0.21 – 0.32	0.35	0.26 – 0.44	0.47	0.35 – 0.60
Carcass Counts by Component						
Solar arrays	0	-	0	-	0	-
Fence line	*3*	*(3) – 6*	*1*	*(1) – 3*	0	-
Gen-tie	30	21 – 39	*1*	*(1) - 3*	0	-
Average Probability of Carcass Availability and Detected (searcher efficiency * average probability of carcass persistence)						
Solar array	0.29	0.23 – 0.35	0.32	0.23 – 0.43	0.84	0.74 – 0.92
Fence line	0.56	0.49 – 0.64	0.68	0.61 – 0.76	0.95	0.93 – 0.98
Gen-tie	0.22	0.17 – 0.27	0.32	0.24 – 0.41	0.48	0.35 – 0.60
Total Overall Detectability (Average Probability of Carcass Availability and Detected * Proportion of Area Searched)						
Solar array	0.12	0.10 – 0.14	0.13	0.10 – 0.17	0.34	0.31 – 0.38
Fence line	0.52	0.45 – 0.59	0.63	0.56 – 0.70	0.88	0.85 – 0.90
Gen-tie	0.11	0.08 – 0.13	0.16	0.12 – 0.20	0.23	0.17 – 0.29
Adjusted Fatality Estimates (Fatalities/Season/Project Component; values in italics are considered unreliable due to low counts of carcasses: carcass count / (proportion of area searched * average probability of carcass availability and detected))						
Solar arrays	*0*	-	0	-	0	-
Fence line	*5.80*	*(3) – 11.62*	*1.66*	*(1) – 4.60*	0	-
Gen-tie	283.74	188.15 – 403.24	*6.38*	*(1) – 19.60*	0	-
Project	289.54	193.58 – 408.43	*8.03*	*(2) – 21.64*	0	-

**For adjusted fatalities, lower bounds in parentheses are actual counts; bootstrap analysis indicated a lower bound of zero.

Appendix E-2. Detections excluded from the fall 2016 fatality analysis at the Blythe Solar Power Project due to: 1) having been detected outside of a regular search area, or 2) having an estimated carcass age that is greater than twice the actual search interval and hence violating assumptions of the Huso estimator.

Parameter	Small Birds	Medium Birds	Large Birds
Solar arrays	0	0	0
Fence line	0	0	0
Gen-tie	8	0	0
Other	2	1	0