Meteorological Tower Fatality Study
at the
Shiloh II Wind Power Project
Solano County, California

Final Report

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ENXCO

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EXECUTIVE SUMMARY

The Shiloh II Wind Power Project Area is situated on roughly 7,800 acres of agricultural land in the Montezuma Hills, near Rio Vista in Solano County, California. The Shiloh II project developers are proposing 112 turbine locations at which the GE 1.5 MW turbines will be installed to produce 168 MW of energy. Ten temporary meteorological towers, operated by enXco, are installed within the proposed Shiloh II Wind Power Project area.

This report details the results of 26 months of a pre-construction meteorological tower fatality study of the proposed Shiloh II wind power project. This is one of three fatality studies of temporary meteorological towers installed in the Collinsville Montezuma Hills Wind Resource Area (CMHWRA). Data from the Shiloh II study is compared with data collected from the adjacent Hamilton Ranch (FPL) and Shiloh I projects (enXco). These three surveys will be used to evaluate the risk of met towers to avian species, and to provide data to help determine if ongoing studies are needed at such towers.

During 26 months of this study, standardized carcass surveys were conducted once per week at five of the ten met towers between February 22, 2006 and April 29, 2008, for a total of 114 complete rounds at these towers. Five more met towers were added to the survey on May 27th, 2006, and an additional 101 rounds were completed at these towers. A total of 1075 individual met tower surveys were conducted in the 26 month period. Clean sweep surveys were conducted once at each tower one week prior to commencement of standardized surveys.

A total of 51 avian incidents were recorded by searchers during standardized met tower surveys, representing 15 species plus 1 unidentified bird. All were fatalities (none were injured birds). Of the 15 species, 1 was a raptor species, a Barn Owl. One Red-tailed Hawk was found incidentally, not during standardized surveys. There were a total of 35 songbird incidents involving 10 species (plus an unidentified sparrow), 2 water bird incidents (a Common Moorhen and Killdeer), and 13 incidents involving Mourning Doves and Rock Pigeons found during this 26 month study. None of the carcasses or injured birds found is listed as federally or state threatened or endangered, or as a California Species of Special Concern. Fifteen percent (15%) of incidents were those of unprotected species, the Rock Dove and European Starling.

The greatest number of incidents occurred in the months of January, October and November of 2007, with a total of 16 (31% of the total) incidents in those three months alone. A large percentage (88%) of these incidents were passerines (n=14), though otherwise, this species group was fairly evenly distributed over the study period.

Incidents were distributed widely throughout the project area's ten met towers with 2 times more incidents north than south, as would be expected based on a random distribution. Based on the number of met towers searched in each of these two areas, the expected number of incidents would reflect a 1.6:1 ratio, north to south, if incidents were distributed randomly.

These two regions (north and south) differ in topography. In comparison to the north, the southern area consists of steeper hills of higher elevations, which open up to a broad plain running south to the Sacramento River and Suisun Marsh.

Multiple fatalities (greater than 3) were recorded at 6 met towers: 733, 735, 736, 737, 738 and 739. Forty-four carcasses, comprising over 86% of all carcasses found, were located at only 60% of the towers surveyed. Twenty-five percent of incidents (n=13) were found at tower 733 alone, 77% of these were passerines (n=10).

Of the 51 incidents found during standardized surveys, 88% were located between 11 and 50 meters of a met tower. Small carcasses were the only size group found within 10 meters, however the majority of small carcasses (41%) were found between 11 and 20 meters. All small carcasses were found within 40 meters. All medium sized birds were found between 16 and 52 meters, with the majority (72%) of these birds found between 21 and 50 meters. There were only 2 large carcasses, and these were found between 27 and 31 meters of a met tower. The only carcasses found outside of the 55 meter search radius were the 3 incidentally found carcasses, which were all found at 90 meters at the same location. In general, medium sized carcasses tended to be distributed somewhat evenly over a larger distance range than small carcasses, which tended to be located closer to the met towers.

Approximately 71% of incidents were found at compass bearings of north to south southeast of the met towers, while wind direction for 69% of surveys where wind direction was recorded, was from the opposite direction, from the south to north northwest. Wind was most likely a factor in the bearing of fatalities.

The vegetation surrounding the met towers consists entirely of agricultural land. It can roughly be sorted into three types of cover: pasture, fallow, and wheat. Fifty-six percent (56%) of the area surveyed was covered in grazed fallow, followed by roughly 31% grazed pasture, 4.3% grazed cut wheat, 5% till, 3.7% tall standing wheat (12-36”), and less than 1% short and medium height wheat (0-12”) combined.

The majority of all incidents were found on grazed fallow (57%), while the majority of all other incidents were found on grazed pasture (41%). One passerine incident was found on cut wheat. No incidents were found on standing uncut wheat or tilled soil. The percentages of birds found on each vegetation type is not far from what would be expected based on the amount of area surveyed on each type of ground cover.

We analyzed the incident data to determine if met tower height affected numbers of incidents found at towers. We were not able to separate height from guy wire configuration as these two variables were the same within each height grouping, thus the degree to which each of these variables attributed to the fatality rate at each tower height was not determined. Based on the number of surveys conducted at met towers of each height, we would expect 1.5 times more incidents to occur at the 60 meter towers. There were more incidents of “Other Birds” (Mourning Doves and Rock Pigeons) and passerines found at 60 meter towers than would be expected based on a random distribution. All but one of the 13 doves and pigeons were located at the 60 meter towers (with a ratio of 1:12) while there were nearly 6 times more songbirds at the 60 meter towers than the shorter towers. We found a deviation from the expected number of bird incidents between 50m and 60m meteorological towers. Incidents were higher than expected at 60m towers (Yates$_{(1)}$ $\chi^2 = 5.11$, $df = 1$, P = 0.02, sig.).

Comparison of unadjusted fatality rates (number of incidents per met tower per year) between species groups at the Shiloh II, Shiloh I and Hamilton project areas shows a greater fatality rate for passerines at Hamilton than the two Shiloh sites, with 2.5 times more passerine incidents at this site (4.80 birds/tower/year). The lowest passerine fatality rate occurred at Shiloh II (1.81 birds/tower/year), however this rate was not dissimilar from Shiloh I (1.92 birds/tower/year). Other birds (doves and pigeons) were found in the greatest numbers at Shiloh II, however due to a two doves found at the Hamilton met tower, the fatality rate for this group was also greatest at the Hamilton site. Overall bird fatality was virtually the same between the two Shiloh sites, and approximately two and a half times as great at Hamilton Ranch. Differences in bird abundance and use of the sites may be responsible for the greater observances of incidents per tower searched at the Hamilton site, as this site is proximal to an olive orchard and a human habitation on which water is available, and provides haven for songbirds and doves during drier years (such as 2007).

The numbers of fatalities recorded at the site in this report are unadjusted. It is recognized that the number of carcasses found under the towers is lower than the total number of birds likely to have been killed. There are at least two factors that need to be accounted for. The first is the possibility that the searchers will miss carcasses. A second possibility is that the carcasses are removed prior to the time the searchers arrive on location after the collision event occurred.

These incidents did not involve threatened and endangered species and are dispersed among several avian species. The impact of the guyed temporary towers is not biologically significant. Enough data has been gathered to enable the county to make informed decisions about the use of these wind monitoring structures.

1.0 INTRODUCTION

Ten temporary meteorological towers, operated by enXco, are installed within the proposed Shiloh II Wind Power Project area (Figure 1).

The ten temporary meteorological towers were searched for carcasses once per week, including a clean sweep survey to remove carcasses before commencing with standardized surveys. Five of the ten "met" towers were clean swept on February 16, 2006, and standardized surveys at those same towers were conducted between February 22, 2006 and April 29, 2008. An additional five met towers were added to the original five in May of 2006, and were given a clean sweep on May 20th, and standardized surveys were conducted at those same towers in tandem with first set of five towers between May 27, 2006 and April 29, 2008. A total of 1075 individual standardized met tower searches were conducted during this 26 month study.

Of the ten met towers installed in the proposed Shiloh II project area, four are 50 meters tall and six are 60 meters tall. Each met tower is a single pole stabilized by sets of guy wires on each of the four sides. The 50 meter towers are equipped with 4 sets of 6 guy wires while the 60 meter towers are equipped with 4 sets of 7 guy wires. The guy wires anchor to the ground at approximately 40 meters from the base of the pole for 50 meter high towers and 50 meters from base for 60 meter high towers. Meteorological data (wind speed and direction, temperature) is collected at each tower in a logger box mounted 5' to 6' above ground. Anemometers and wind direction gauges are mounted on booms attached to the towers at three levels beginning at the top and spaced at 10 meter intervals.

The report that follows examines the data generated from fatality searches conducted at temporary meteorological towers on the Shiloh II site between February 22, 2006 and April 29, 2008 (approximately a 26 month period), and compares these data with studies done for the adjacent Hamilton Ranch (FPL) and Shiloh I projects (enXco). These surveys will be used to evaluate the risk of met towers to avian species, and to provide data to help determine if ongoing studies are needed at such towers.

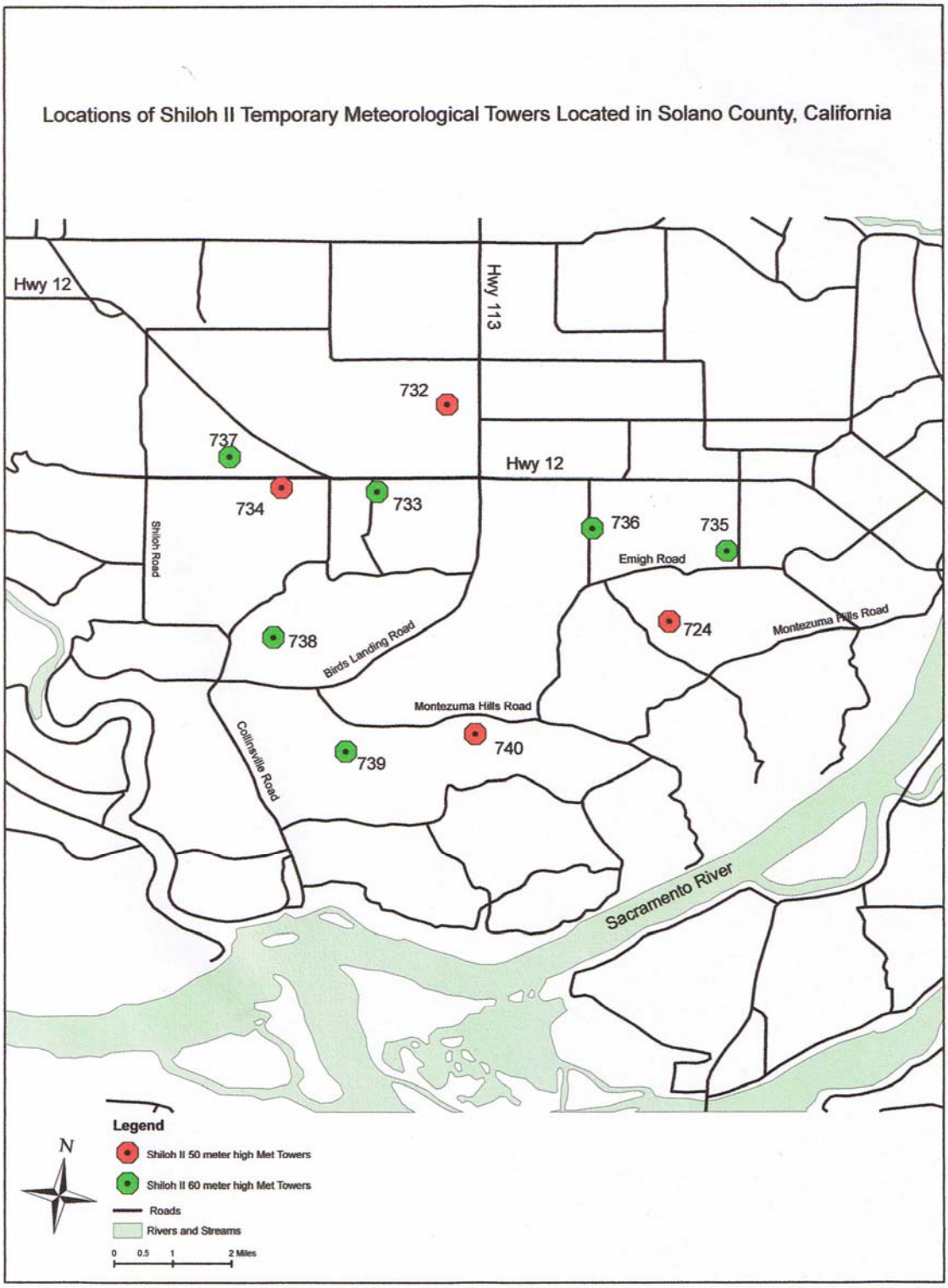

Figure 1. Locations of 10 temporary meteorological towers in the Shiloh II Project Area, Solano County, California, surveyed February 2006 - April 2008.

2.0 METHODS

2.1 Meteorological Tower Carcass Surveys

2.1.1 Clean Sweep Surveys: Prior to the start of the carcass surveys, a "clean sweep" was conducted at all installed temporary meteorological towers to remove all carcasses and remains of carcasses from the survey area. Clean sweeps were conducted using the same protocol as used in the standardized carcass surveys (see below). The thoroughness of the sweep was adopted to increase the likelihood that all carcasses found during the subsequent surveys would be associated with incidents that occurred during the course of the systematic surveys, and remove the possibility that scavengers or wind could relocate remains between towers. The clean sweep for 5 of all 10 met towers was executed February 16, 2006 and for the remaining 5 met towers on May 20th. Standardized surveys of towers started about one week following the clean sweeps, on February 22, 2006 and May 27, 2006, respectively for the two groups of five met towers.

2.1.2 Standardized Surveys: During the 26 months of this project, carcass surveys were conducted approximately once per week at the same five temporary meteorological towers (numbered 732, 733, 734, 735, and 738) between February 22, 2006 and April 29, 2008, for a total of 114 rounds. In May, five more met towers were added to the survey (numbered 724, 736, 737, 739, and 740), and standardized surveys at those towers were conducted between May 27, 2006 through April 29, 2008, for a total of 101 rounds in 23 months of surveys. Consecutive rounds were started 1 met tower beyond where the previous survey had started, thus surveys were insured to be surveyed at various times of day.

The survey consists of searchers walking in concentric circles around the met tower's base at distances of 10, 20, 30, 40, and 50 meters, and also around the base of each tower (Figure 2). While walking around each ring, the searcher using the unaided eye, alternately scans an area that extends for 5m in either side of his track, yielding a total of 55 meters scanned (an area of 9503.3 square meters). The surveyors use range finders to initially establish and periodically check the distance of each circular route from the tower. Data recorded at the beginning of the surveys includes meteorological data (cloud cover, temperature, and wind velocity) and ground cover information (crop type and height). In addition, the start and finish times are recorded for each tower searched (see Appendix A).

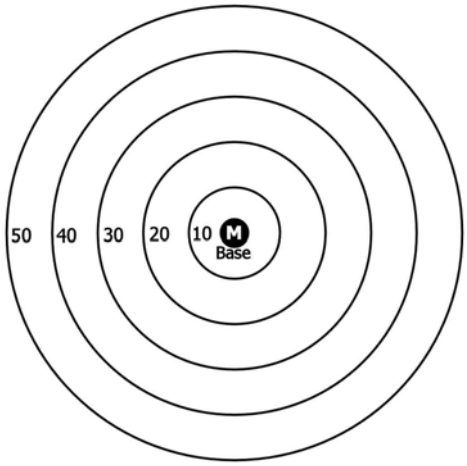

Figure 2. Search pattern for meteorological tower carcass survey (distance in meters)

When a carcass or injured bird or bat is found, the searchers perform a thorough investigation and documentation of the incident using the protocols listed in the Wildlife Response and Reporting System (WRRS). An incident report number is assigned and an incident report form filled out for each find (Appendix B). A GPS is used to determine geographic coordinates, and a range finder and compass are used to determine distance and bearing from the tower. The carcass is photographed in the position in which it is found (in situ) using a digital camera. After identifying the animal by species (including age and sex when possible), an examination is performed to determine the nature and extent of any injuries, and whether any scavenging or insect infestation has occurred. The time since death is estimated and recorded. In case of dismemberment, the surveyors search the vicinity to locate all body parts. Loose feathers are only considered fatalities if enough feathers are found to represent a dead bird. All loose feathers are collected in order to avoid identifying the feathers as an additional kill during the next survey of the tower. The carcass is then placed in a plastic bag labeled with date, species, met tower number, and incident report number, and taken to a freezer to be stored in accordance with the FWS permit requirements. When carcasses are found at times and locations outside of one of the standardized surveys conducted as part of this study, such as while driving between sites, the carcass is processed as above but it is classified as an "incidental" find, and is not included as part of the standardized incident data set.

When an injured animal is found, the searchers record the same data collected for a carcass (noting however, that it is an injury and not a fatality). The searchers then capture and restrain the animal in a manner to avoid either further injury to the animal or injury to the survey crew. Once the animal is secured it is transported to a wildlife rehabilitator or veterinarian. The hospital accession number and the final disposition of the animal are recorded on the report form.

Only in those cases where the injury to the animal can be linked to a specific met tower is a tower number recorded as the location in the report. When no corroborating information that the injury is linked to a tower is available, the animal is simply recorded as having been found "ON SITE". For instance, if a bird is found injured with a broken wing but is still mobile, it would

not be associated with a specific met tower because it could have moved and the cause of incident cannot be assigned.

If the carcass or injured animal found is listed as a threatened or endangered species, the Avian Respondent, listed in the WRRS, is notified immediately by phone, and collection of the dead animal is delayed until specific direction for proceeding is received from the U.S. Fish and Wildlife Service. All Golden Eagle fatalities or injuries (if found) are reported to the U.S. Fish and Wildlife Service.

3.0 RESULTS

3.1 Meteorological Tower Carcass Surveys

3.1.1 Clean Sweep Surveys. A total of 5 clean sweep surveys were conducted February 16, 2006, totaling 1 round of surveys (ie. an individual survey) at five towers (732, 733, 734, 735, and 738) of the project area's 10 temporary meteorological towers. A total of 5 clean sweep surveys were conducted May 20, 2006, totaling 1 round of surveys the remaining five towers (724, 736, 737, 739, and 740). No carcasses were found during clean sweep surveys.

3.1.2 Standardized Surveys. A total of 114 complete rounds of standardized searches were conducted at the first set of five met towers (732, 733, 734, 735, and 738) between February 22, 2006 and April 29, 2008 on 121 days (15% of the days of the 26 month period), for a total of 570 complete individual met tower searches at those towers. A total of 101 complete rounds of standardized searches were conducted at the second set of five met towers (724, 736, 737, 739, and 740) between May 27, 2006 and April 29, 2008 on 108 days (15% of the days of the 23 month period), for a total of 505 complete individual met tower searches at those towers. At all ten met towers, a combined total of 1075 complete individual tower searches were conducted. The average number of temporary met towers surveyed during the first 26 months of this project was 9.43. The average number of days between successive searches for each tower was 7.04 days (Standard Deviation = 1.53). For the purpose of calculating fatality rates (number of incidents/tower/year), we used the average number of months all towers were surveyed (as half were surveyed for 23 of 26 months), which was 24.7 months or 2.055 years.

During the first 26 months of this study, a grand total of 54 incidents were recorded (Table 1). Of 54 incidents, 51 incidents were found during standardized surveys, and an additional 3 were found in between surveys, or "incidentally", and all of these latter incidents were classified as "incidental" finds (Appendix C).

Table 1. Number of temporary meteorological tower related incidents per species at the Shiloh II Project Area, February 22, 2006 – April 29, 2008, found during standardized surveys and incidentally.

Species	# Incidents		Total
	Standardized	Incidental	
American Pipit	4		**4**
Barn Owl	1		**1**
Brewer's Blackbird	3	1	**4**
Common Moorhen	1		**1**
Dark-eyed Junco	1		**1**
European Starling	1		**1**
Horned Lark	6		**6**
Killdeer	1		**1**
Mourning Dove	6		**6**
Pacific-Slope Flycatcher	1		**1**
Red-tailed Hawk		1	**1**
Red-winged Blackbird	9		**9**
Rock Pigeon	7		**7**
Savannah Sparrow	3		**3**
Unidentified Sparrow	1		**1**
Western Meadowlark	5	1	**6**
White-crowned Sparrow	1		**1**
Grand Total	**51**	**3**	**54**

A total of 51 met tower related avian incidents, were recorded by searchers during standardized surveys, representing 15 species plus 1 unidentified sparrow. All of these were fatalities. Of the 15 avian species, 1 was a raptor species, a single Barn Owl incident. One Red-tailed Hawk was found incidentally. The greatest number of carcasses found were those of songbirds, this group comprised 35 incidents identified to 10 different species plus an unidentified sparrow (Table 2). There was a total of 2 water birds incident, a Common Moorhen and a Killdeer. Other avian species ("Other Birds") included Mourning Doves and Rock Pigeons, comprising 13 incidents. None of the carcasses or injured birds found is listed as federally or state threatened or endangered, or as a California Species of Special Concern. Fifteen percent (15%) of incidents were those of unprotected species, the Rock Dove and European Starling.

Table 2. Number of incidents per species grouping (raptors, water birds, other birds, passerines), found during the first 26 months of standardized surveys at met towers

Species Group	Total
Raptor (owl)	1
Water Bird (moorhen, killdeer)	2
Other Bird (dove, pigeon)	13
Passerine	35
Grand Total	51

The number of met tower related incidents found per tower per year was calculated to provide a comparable metric between different wind power projects (Table 3).

Table 3. Unadjusted number of incidents per species during 26 months of surveys per met tower per year, at the Shiloh II Project Area, February 2006 – April 2008, found during standardized surveys.

Species	# Incidents	# Incidents per Tower/Year*
American Pipit	4	0.2064
Barn Owl	1	0.0516
Brewer's Blackbird	3	0.1548
Common Moorhen	1	0.0516
Dark-eyed Junco	1	0.0516
European Starling	1	0.0516
Horned Lark	6	0.3096
Killdeer	1	0.0516
Mourning Dove	6	0.3096
Pacific-Slope Flycatcher	1	0.0516
Red-winged Blackbird	9	0.4645
Rock Pigeon	7	0.3613
Savannah Sparrow	3	0.1548
Unidentified Sparrow	1	0.0516
Western Meadowlark	5	0.2580
White-crowned Sparrow	1	0.0516
Grand Total	**51**	**2.6320**

* The number of incidents per tower per year was calculated by dividing the number of incidents per species by the average number of met towers surveyed throughout the 26 month survey (9.43), and then dividing this number by the average number of years surveyed (2.055 years, or 24.7 months, the average period of time the two sets of 5 met towers were surveyed).

Unadjusted fatality rates were also calculated for each species grouping (raptors, passerines, water birds and other birds). Passerines were found at the greatest rate, 1.81 songbirds per met tower per year (Table 4).

Table 4. Unadjusted number of incidents per species group during 26 months of surveys per met tower per year, at the Shiloh II Project Area, February 2006 – April 2008, found during standardized surveys.

Species Group	# Incidents	# Incidents per Tower/Year*
Raptor (owl)	1	0.0516
Water Bird (moorhen, killdeer)	2	0.1032
Other Bird (dove, pigeon)	13	0.6709
Passerine	35	1.8063
Grand Total	**51**	**2.6320**

Species Group	# Incidents	# Incidents per Tower/Year*

* The number of incidents per tower per year was calculated by dividing the number of incidents per species by the average number of met towers surveyed throughout the 26 month survey (9.43), and then dividing this number by the average number of years surveyed (2.055 years, or 24.7 months, the average period of time the two sets of 5 met towers were surveyed).

The number of met tower associated incidents found during standardized surveys was calculated per month for each species grouping (Table 5). The estimated month of death or injury was determined by subtracting the estimated number of days since death or injury from the report date.

The greatest number of incidents occurred in January of 2007, with a total of 5 (10% of the total) incidents in that month, and also in October through November 2007, with 11 (22% of the total) incidents in those two months alone. The majority (88%) of these incidents were passerines, though otherwise, this species group was fairly evenly distributed over the 26 month study period. The single raptor (Barn Owl) incident occurred in May 2007, during the breeding season. The water bird incidents occurred in December 2006 (Common Moorhen) and February 2008 (Killdeer). The "other bird" (dove and pigeon) incidents were distributed more evenly over the months. In general, numbers of incidents were low and did not vary greatly between months.

Table 5. Number of met tower related incidents per species grouping per month*

	2006										2007												
Species Group	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
Raptor															1								
Water Bird										1													
Other Bird	1		2		1											2	1	1			2		1
Passerine	1			1	1	2	1	3		1	5	2		1	2		1		1	6	3		3
Total	**2**		**2**	**1**	**2**	**2**	**1**	**3**		**2**	**5**	**2**		**1**	**3**	**2**	**2**	**1**	**1**	**6**	**5**		**4**

*Estimated month of death, was calculated by subtracting the estimated number of days since death from the report date. These numbers include incidents with known of death, which were associated with met towers and found during standardized surveys only.

The majority of incidents which could be identified to age were adults (Table 6), however approximately 27% of incidents were not identified to age because of missing feathers or body parts. Of the 37 incidents which were identifiable, 89% were adults and 11% were first year birds. The single Barn Owl incident was an adult. The Common Moorhen was a first year bird. Of the passerine and other bird incidents which could be aged, the majority were adult.

Table 6. Age classes of avian species met tower related incidents.

	Age			
Species	Adult	First Year	Unknown	**Total**
American Pipit	2		2	**4**
Barn Owl	1			**1**
Brewer's Blackbird	3			**3**
Common Moorhen		1		**1**
Dark-eyed Junco	1			**1**

Species	Age: Adult	First Year	Unknown	Total
European Starling			1	**1**
Horned Lark	5	1		**6**
Killdeer			1	**1**
Mourning Dove	4		2	**6**
Pacific-Slope Flycatcher	1			**1**
Red-winged Blackbird	7	2		**9**
Rock Pigeon	3		4	**7**
Savannah Sparrow	1		2	**3**
Unidentified Sparrow			1	**1**
Western Meadowlark	5			**5**
White-crowned Sparrow			1	**1**
Total	**33**	**4**	**14**	**51**

3.2 Vegetative Cover

The vegetation surrounding the met towers consists entirely of agricultural land. It can roughly be sorted into three types of cover: pasture, fallow, and wheat. All towers other than 734, 737, and 739 were grazed pasture or fallow. See Table 7 for details on the vegetative cover surrounding each tower.

Though the majority of met towers were surrounded by a constant vegetation type of grazed pasture during the 26 months of the study, vegetative cover in agricultural land changes over time, therefore the percentage of surveys conducted within each vegetation type is used as the unit of area surveyed within each vegetation type. The proportion of surveys conducted, or proportion of area covered during surveys, is given in Table 8. Fifty-six percent of the area surveyed was covered in grazed fallow, followed by roughly 31% grazed pasture, 4.3% grazed cut wheat, 5% till, 3.7% tall standing wheat (12-36”), and less than 1% short and medium height wheat (0-12”) combined.

Table 7. Vegetative cover at each temporary meteorlogical tower.

Tower #	VEGETATIVE COVER
732	grazed pasture
733	grazed pasture
736	grazed pasture
738	grazed fallow
735	grazed fallow
740	grazed fallow
724	grazed fallow
739	grazed fallow, then tilled on 12/17/07
734	wheat 12-36", harvested 7/25/06, grazed cut wheat until 12/31/06, then grazed fallow until 5/22/07, then tilled, wheat <6” (short) 1/23/08 – 2/6, wheat 6-12” (med) 2/15-3/1, wheat 12-36” (tall) 3/5-4/29/08

Tower #	VEGETATIVE COVER
737	wheat 12-36", harvested 7/25/06, grazed cut wheat until 12/31/06, then grazed fallow

The greatest number of incidents were found on grazed fallow (56.9%) while the majority of all other incidents were found on grazed pasture (41.1%; Table 8). One passerine incident was found on cut wheat. No incidents were found on standing, uncut wheat or tilled soil. The standing wheat ranged between short (<6" in height) to tall (12-36") during this study, and comprised only 4.3% of the surveys conducted, or area surveyed, on this vegetation type. Vegetation height is likely a factor affecting visibility of carcasses. Tilled soil comprised only 5.1% of the surveys conducted, and because of its dark color and rugged terrain, it can also affect carcass visibility. Without searcher efficiency tests on each vegetation type, we are unable to predict their effects on visibility, however the percentages of birds found on each vegetation type is not far from what would be expected based on the amount of area surveyed (percentage of surveys) on each type of ground cover.

Table 8. Comparison of the proportion of incidents within each species group found on each vegetation type, versus the proportion of the area surveyed per vegetation type.

Vegetation Type	Ground Cover	% Incidents				% All Bird
	% Surveys	Raptor	Water Bird	Dove	Passerine	Species
Wheat, short (<6")	0.3					
Wheat, med (6-12")	0.3					
Wheat, tall (12-36")	3.7					
Cut Wheat, grazed	4.3				2.9	2.0
Fallow, grazed	55.7	100		77.0	51.4	56.9
Pasture, grazed	30.6		100	23.0	45.7	41.1
Till	5.1					
% All Vegetation Types	100	2.0	3.9	25.5	68.6	100

3.3 Locations of Incidents

The general locations of the 51 incidents found during standardized surveys are given in Figure 3. This map shows the general spatial distribution of incidents, indicating the number of incidents found at each tower, but does not show the exact location of each incident. For actual locations of met tower incidents, refer to Appendix C.

3.3.1 Spatial Distribution: North - South Regions

To determine if incidents were distributed within the project area in a way other than what would be expected in a random distribution based on the numbers of surveys conducted at towers in those areas, we divided the data into area groupings. The ten met towers were roughly clustered in two topographically different regions: the "North" (732, 733, 734, 735, 736 and 737) and "South" (724, 738, 739 and 740). The two areas are divided by Emigh Road, which runs E to W just south of met towers 735 and 736, and by an imaginary line extending west from where

Emigh Road ends (near intersection with Currie Road). The north is flatter in terrain than the south. The six towers in the north are situated near Highways 12 and 113, and Little Honker Bay, Currie, Emigh, and Azevedo Roads (Figure 1). The four towers in the south are located near Birds Landing, Olsen, Anderson and Montezuma Hills Roads. The number of surveys conducted at towers within each region was used to calculate the expected ratio of incidents found at those towers, which for this 26 month study period, was 1.6 to 1, North to South. Using the number of surveys as opposed to the number of met towers accounts for the addition of five met towers to the study in May of 2006, which affects the degree to which each area was searched.

There appeared to be no difference in spatial distribution from what was expected of incidents of all avian species lumped (Table 9). There were over three times as many "Other Bird" incidents in the North than the South, however numbers are still low to make conclusions.

Table 9. Comparison of avian incidents to met tower distribution, with met towers divided into two areas, North and South*.

	Number			**Ratio**	
	North	South	Total	North	South
Number of Surveys	658	417	1075	1.6	1
Incidents					
Raptor (Barn Owl)		1	1	0	1
Water Bird (moorhen, killdeer)	2		2	2	0
Other Bird (dove, pigeon)	10	3	13	3.3	1
Passerine	22	13	35	1.7	1
Total	**34**	**17**	**51**	**2**	**1**

* The "North" was defined as towers 732, 733, 734, 735, 736, and 737, and was situated near Highways 12 and 113, Little Honker Bay, Currie, Azevedo and Emigh Roads. The "South" was defined as 724, 738, 739 and 740, and was located near Birds Landing, Anderson, Montezuma Hills and Olsen Roads. The southern towers are characterized by having more hilly terrain than the "North".

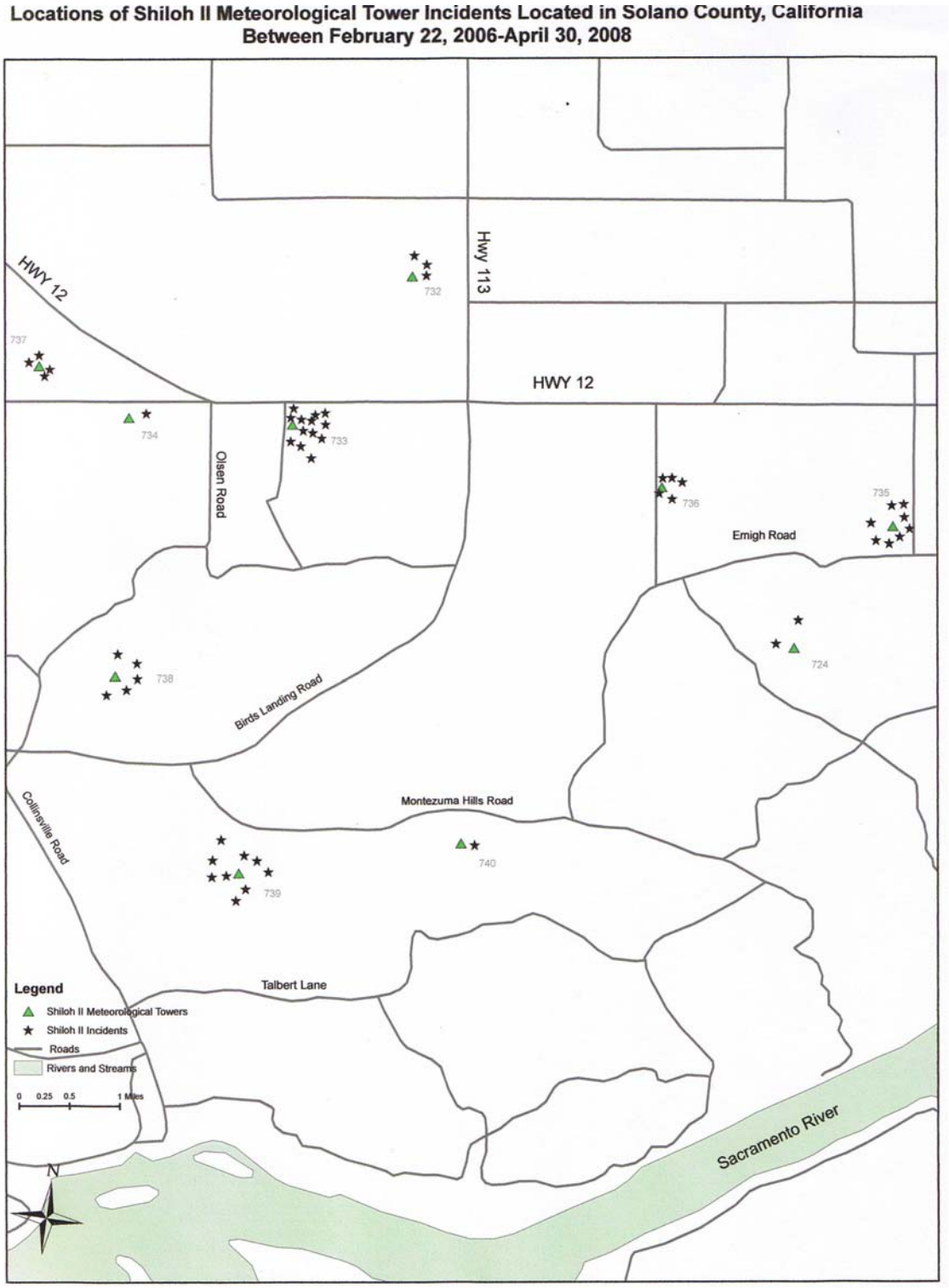

Figure 3. Locations* of incidents found during standardized surveys at met towers at Shiloh II, February 22, 2006 through April 29, 2008.

* This map shows the general spacial distribution of incidents, indicating the number of incidents found at each tower, but does not show the exact location of each incident. The area surveyed in the Shiloh II met tower study was too large to show details on a single map.

Multiple fatalities (greater than 3) were recorded at 6 met towers: 733, 735, 736, 737, 738 and 739. Forty-four carcasses, comprising over 86% of all carcasses found, were located at only 60% of the towers. Towers 736, 737, and 739 (3 of the 6) were surveyed for only 23 months of the 26 month study. Twenty-five percent of incidents were found at tower 733 alone, 77% of these were passerines. Interestingly, each of the four 50 meter tall towers had 3 or less incidents, while all of the towers with greater than 3 fatalities were 60 meters tall (see section 3.4 Met Tower Height and Guy Wire Configuration, below).

Table 10. The number of incidents per species grouping found at each tower.

	Species Group				
Tower	Raptor	Water Bird	Other Bird	Passerine	**Grand Total**
724			1	1	2
732				3	3
733*		2	1	10	13
734				1	1
735*			4	4	8
736*			2	3	5
737*			3	1	4
738*			1	4	5
739*			1	8	9
740	1				1
Grand Total	1	2	13	35	51

* Met towers are of the taller variety, are 60 meters in height.

3.3.2 Distance from Towers

Species were lumped into size groupings (Table 11) to determine if species size influences distance of a carcass from a met tower, and also to determine if surveying a 55 meter radius area is an effective method for finding the majority of carcasses. The number of incidents of species (found during standardized surveys only) falling into each size grouping were then tabulated based on distance (range) from the met tower (Table 12).

Table 11. Species size groupings used in analyses.

Category	Description
Small Bird	$\leq$ 8” length (most smaller passerines)
Medium Bird	8” < X $\leq$ 14” length (kestrels, flickers, starlings, blackbirds, doves, rails)
Large Bird	> 14” length (most raptors, moorhens, coots, ducks, pheasants)

Of the 51 incidents found during standardized surveys, 88% were located between 11 and 50 meters of a met tower (Table 12). Small carcasses were the only size group found within 10 meters, with 18% of carcasses in that size group found at that distance range. The greatest number of small carcasses (41%, n=7 of 17 total) were found between 11 and 20 meters. All small carcasses were found within 40 meters. All medium sized birds were found between 16

and 52 meters, with the majority (72%) of these birds found between 21 and 50 meters. There were only 2 large carcasses, and these were found at 27 and 31 meters of a met tower. The only carcasses found outside of the 55 meter search radius were the 3 incidentally found incidents (Appendix D), which were all found at 90 meters at the same location.

In general, medium sized carcasses tended to be distributed somewhat evenly over a larger distance range than small carcasses, which tended to be located closer to the met towers. There were too few large sized carcasses to make solid conclusions at this time.

Table 12. Number of incidents per size grouping versus distance from met tower

	Distance Range (meters)						Grand
Size Group	*0-10*	*11-20*	*21-30*	*31-40*	*41-50*	*51-55*	**Total**
Small	3	7	3	4			17
Medium		6	7	7	9	3	32
Large			1	1			2
Grand Total	3	13	11	12	9	3	51

3.3.3 Bearing from Towers

Compass bearing was recorded for all incidents from tower to carcass (see Appendix C for individual incident bearings given in degrees geographic north), and is likely to correspond roughly to wind direction. Wind direction was recorded during 96% of the surveys. While the wind direction recorded during surveys may not accurately represent the direction of the wind blowing at the moment of the incident, wind direction is in general somewhat seasonal and similar from one day to the next. Approximately 71% of incidents were found north to south southeast of the met towers (Table 13), while wind direction for 69% of surveys where wind direction was recorded, was from the opposite direction, from the south to north northwest.

Table 13. The number of incidents within each species group found at each compass bearing.

Compass	# Incidents				Total Incidents	
Bearing	Raptor	Water Bird	Other Bird	Passerine	#	%
N		1	3	6	10	19.6
NNE			1	2	3	5.9
NE				1	1	2.0
ENE			2	4	6	11.8
E			1	4	5	9.8
ESE	1			3	4	7.8
SE			1	2	3	5.9
SSE			1	3	4	7.8
S				1	1	2.0
SSW			1	1	2	3.9
SW				2	2	3.9

Compass Bearing	# Incidents				Total Incidents	
	Raptor	Water Bird	Other Bird	Passerine	#	%
WSW			1	4	5	9.8
W				1	1	2.0
WNW		1			1	2.0
NW				1	1	2.0
NNW			2		2	3.9
Total	1	2	13	35	51	100.0

3.4 Met Tower Height and Guy Wire Configuration

The ten met towers differed in height and the number of guy wires (Table 14). Of the ten met towers, four were 50 meters tall and six were 60 meters tall. The 50 meter towers were equipped with 4 sets of 6 guy wires while the 60 meter towers were equipped with 4 sets of 7 guy wires. The guy wires anchored to the ground at approximately 40 meters from the base of the pole for 50 meter high towers and 50 meters from base for 60 meter high towers.

Table 14. Height and guy wire configuration for each met tower in the Shiloh II Project Area.

Tower #	Tower Height (m)	# Guy Wires
724	50	4 sets of 6 guy wires
732	50	4 sets of 6 guy wires
734	50	4 sets of 6 guy wires
740	50	4 sets of 6 guy wires
733	60	4 sets of 7 guy wires
735	60	4 sets of 7 guy wires
736	60	4 sets of 7 guy wires
737	60	4 sets of 7 guy wires
738	60	4 sets of 7 guy wires
739	60	4 sets of 7 guy wires

We analyzed the incident data to determine if met tower height affected numbers of incidents found at towers (Table 15). We were not able to separate height from guy wire configuration as these two variables were the same within each height grouping, thus the degree to which each of these variables attributed to the fatality rate at each tower height was not determined. Based on the number of surveys conducted at met towers of each height, we would expect 1.5 times more incidents to occur at the 60 meter towers.

There were more incidents of "Other Birds" (Mourning Doves and Rock Pigeons) and passerines found at 60 meter towers than would be expected based on a random distribution. All except one of the doves and pigeons were located at the 60 meter towers (with a ratio of 1:12) while there

were 6 times more songbirds at the 60 meter towers than the shorter towers (ratio 1:6). The numbers of raptors and water birds are too low to determine any trends.

Table 15. Comparison of the number of avian incidents to met tower height in meters (and guy wire configuration*)

	Number			Ratio	
	50m	**60m**	**Total**	**50m**	**60m**
Number of Surveys	430	645	1075	1	1.5
Incidents					
Raptor (owl)	1		1	1	0
Water Bird (moorhen, killdeer)		2	2	0	2
Other Bird (dove, pigeon)	1	12	13	1	12
Passerine	5	30	35	1	6
Grand Total	**7**	**44**	**51**	**1**	**6.3**

* Towers of similar height had similar guy wire configuration: 50m towers were equipped with 4 sets of 6 guy wires while 60m towers were equipped with 4 sets of 7 guy wires. These two variables were not separated.

We weighted the number of incidents by the number of surveys and conducted chi-square tests for independence for the number of bird incidents (all species) detected at 50m and 60m towers at Shiloh II.

We found a deviation from the expected number of bird incidents between 50m and 60m meteorological towers. A Chi-squared test found some evidence that incidents were higher than expected at 60m towers ($\div^2 = 3.91$, $df = 1$, $P = 0.05$). However, due to the low number of incidents, Yates' chi-square correction was required. After applying the correction, the difference in proportion of incidents between 50m and 60m towers was deemed no longer significant ($\text{Yates}_{(1}\ \div^2 = 2.33$, $df = 1$, $P = 0.13$, n.s.)

Table 16. Contingency table showing the proportion of bird incidents at 50m vs. 60m at Shiloh II meteorological towers.

	# Met. towers	**# Bird Incidents**	**Sum**
50m tall	4	7	11
60m tall	6	44	50
Sum	10	51	61

(1) The expected frequency was less than 5 in more than 20% of the contingency test cells, necessitating the use of Yates' correction.

4.0 DISCUSSION

This report details 26 months results of a pre-construction study of fatalities found at enXco temporary meteorological towers within the Shiloh II Project Area. This is one of three fatality studies being conducted concurrently at met towers installed in the Collinsville Montezuma Hills Wind Resource Area (CMHWRA). The Shiloh II, along with the adjacent Shiloh I (conducted May 16, 2006 – April 28, 2008) and Hamilton Ranch met tower (February 6, 2007 – April 29, 2008) studies, will provide an expanded opportunity to examine and compare the impact of temporary met towers on the avian fauna in the CMHWRA.

Due to the similarity of terrain and land use practices throughout the CMHWRA we would expect to find an overlap of met tower-related incident species composition among the wind project developed areas of the WRA. In addition, because the same team of individuals has been conducting the surveys at the Shiloh II, Shiloh I and Hamilton projects using the same protocols, it is reasonable to expect that the data collected should be comparable. If there are biases or idiosyncrasies for better or worse they too remain constant.

4.1 Fatalities at Three Adjacent Sites

Table 17 compares specific attributes of these three adjacent developments within the CMHWRA.

Table 17. Comparison of Shiloh I, Shiloh II, and Hamilton attributes or metrics (includes standardized data from variable periods, inclusive of all data collected from the beginning of each study through April 2008)

Attribute or Metric	Shiloh I	Shiloh II	Hamilton Ranch
Number of Met Towers	4	10 (av. 9.43)	1
Height (AGL)	50m	50m (4), 60m (6)	50m
Average Number** of Months Surveyed (used for calculations)	23.4	24.7**	15
Study Dates	May 16, 2006 – April 28, 2008	February 22, 2006 – April 29, 2008	February 6, 2007 – April 29, 2008
Search Interval (in days)	7 days	7 days	7 days
Number of Birds Found	20	51	8
Number of Raptors Found	1	1	0
Number of Songbirds Found	15	35	6
Number of Birds Killed per Met Tower per Year	2.560	2.632	6.40
Number of Raptors Killed per Met Tower per Year	0.128	0.052	0
Number of Songbirds Killed per Met Tower per Year	1.920	1.806	4.80

* The number of incidents per tower per year was calculated by dividing the number of incidents per species group by the average number of met towers surveyed throughout the survey, and then dividing this number by the number of years the site was surveyed.

** Two sets of 5 met towers at Shiloh II were surveyed for different numbers of months, together averaging 24.7 months, used for fatality rate calculations: towers 732, 733, 734, 734, 738 were surveyed ~26 months, and towers 724, 736, 737, 739, and 740 were surveyed ~23 months.

When comparing the fatality rates of each species recorded between the three sites (Table 18), we find not as much overlap in the species impacted as would be expected based on similarities in met tower structure, study methods, and general geographic location, habitat, and terrain. With the exception of the methodology, which was the same for each study, these other factors may have contributed to differences in incident composition between sites.

Of the three sites, raptors were only found at Shiloh I and II, an American Kestrel (1) and a Barn Owl (1), respectively. Along with the Barn Owl, species found only at Shiloh II included: Brewer's Blackbird (3), Dark-eyed Junco (1), European Starling (1), Horned Lark (6), Pacific-slope Flycatcher (1), Savannah Sparrow (3), White-crowned Sparrow (1), and Common Moorhen (1). A single Loggerhead Shrike was found at Hamilton Ranch, a California Species of Special Concern not found at either of the other two sites. Species found only at the Shiloh I site included the American Kestrel (1), a Barn Swallow (1), and a Lincoln Sparrow (1). The species overlapping between sites were American Pipits, Killdeers, Mourning Doves, Rock Pigeons (not present at Hamilton), Red-winged Blackbirds, and Western Meadowlarks.

The number of incidents per species is low at this time, so conclusions about differences in fatality rates will be limited to comparing larger sample sizes by lumping species into species groups.

Table 18. Comparison of unadjusted number of incidents per species per met tower per year at Shiloh I (23.4 months of surveys), Shiloh II (24.7 months), and Hamilton Ranch (15 months), found during standardized surveys

	Shiloh I		Shiloh II		Hamilton	
Species	# Incidents	# Incidents /Tower/Yr	# Incidents	# Incidents /Tower/Yr	# Incidents	# Incidents /Tower/Yr
American Kestrel	1	0.1280				
American Pipit	1	0.1280	4	0.2064		
Barn Owl			1	0.0516		
Barn Swallow	1	0.1280				
Brewer's Blackbird			3	0.1548		
Common Moorhen			1	0.0516		
Dark-eyed Junco			1	0.0516		
European Starling			1	0.0516		
Horned Lark			6	0.3096		
Killdeer	1	0.1280	1	0.0516		
Lincoln's Sparrow	1	0.1280				
Loggerhead Shrike					1	0.8000
Mourning Dove	2	0.2560	6	0.3096	2	1.6000
Pacific-Slope Flycatcher			1	0.0516		
Red-winged Blackbird	6	0.7679	9	0.4645	3	2.4000
Rock Pigeon	1	0.1280	7	0.3613		
Savannah Sparrow			3	0.1548		
Western Meadowlark	4	0.5119	5	0.2580	2	1.6000
White-crowned Sparrow			1	0.0516		
Unidentified Passerine	1	0.1280				

Species	Shiloh I # Incidents	Shiloh I # Incidents /Tower/Yr	Shiloh II # Incidents	Shiloh II # Incidents /Tower/Yr	Hamilton # Incidents	Hamilton # Incidents /Tower/Yr
Unidentified Sparrow			1	0.0516		
Unidentified Swallow	1	0.1280				
Total	**20**	**2.5596**	**51**	**2.6320**	**8**	**6.4000**

When comparing fatality rates of species groups, we see dramatic differences between sites (Table 19), however numbers are still low at this time, and do not take into account variables which may need to be factored into the equation, like scavenger removal of carcasses and searcher efficiency. Looking at unadjusted fatality rates between sites, the highest rate of passerine fatality, with approximately 2.5 times the rate occurring at either of the two other sites, occurred at Hamilton (4.80 birds/tower/year). The lowest passerine fatality rate occurred at Shiloh II (1.81 birds/tower/year), however this rate was not dissimilar from Shiloh I (1.92 birds/tower/year). Other birds (doves and pigeons) were found in the greatest numbers at Shiloh II, however due to two doves found at the Hamilton met tower, the fatality rate for this group was also greatest at the Hamilton site. Overall bird fatality was virtually the same between the two Shiloh sites, and approximately two and a half times as great at Hamilton Ranch.

Table 19. Comparison of unadjusted number of incidents per species grouping per met tower per year at Shiloh I (23.4 months of surveys), Shiloh II (24.7 months), and Hamilton Ranch (15 months), found during standardized surveys

Species Group	Shiloh I # Incidents	Shiloh I # Incidents /Tower/Yr	Shiloh II # Incidents	Shiloh II # Incidents /Tower/Yr	Hamilton # Incidents	Hamilton # Incidents /Tower/Yr
Raptor	1	0.1280	1	0.0516		
Water Bird	1	0.1280	2	0.1032		
Other Bird	3	0.3839	13	0.6709	2	1.6000
Passerine	15	1.9197	35	1.8063	6	4.8000
Grand Total	**20**	**2.5596**	**51**	**2.6320**	**8**	**6.4000**

Differences in bird abundance and use of the sites may be responsible for the greater observances of incidents per tower searched at the Hamilton site. The 2005-2006 rainy season was extraordinarily wet, while 2006-2007 was unusually dry which would affect vegetation and food abundance, which may have resulted in higher fatality rates during the 2007 Hamilton study, as this site is proximal to an olive orchard and a human habitation on which water is available.

4.2 Shiloh I: Post-Construction Wind Turbine – Met Tower Comparison

For the purpose of determining the potential relative impact of meteorological towers on birds, we can compare met tower related incidents to wind turbine related incidents at the post-construction site, Shiloh I, where wind turbine tower carcass searches were conducted in tandem with met tower searches. The number of birds killed or injured associated with wind turbines at the Shiloh I site for the study period was 2.93 birds per wind turbine per year (Table 20). The

fatality rate at met towers at Shiloh I was 2.61 birds per met tower per year. There were 50 species (plus unidentified birds) found at wind turbines, whereas there were only 9 species (plus unidentified birds) at met towers. While species diversity of incidents and fatality rate of all bird species combined was greater at wind turbine towers than met towers at Shiloh I, the fatality rate of passerine species was nearly the same between met towers (1.96 songbirds/tower/year) and wind turbine towers (1.93 songbirds/tower/year). Interestingly, bat fatalities were recorded only at wind turbine towers, and were found at none of the three project areas at met towers.

Table 20. Comparison of unadjusted number of incidents per species grouping per wind turbine and per met tower per year at Shiloh I, found during standardized surveys

SHILOH I	**Wind Turbine Towers** April 10, 2006 – April 14, 2008		**Meteorological Towers** May 16, 2006 – April 14, 2008	
Species Group	# Incidents	# Incidents /Tower/Yr	# Incidents	# Incidents /Tower/Yr
Bird Species				
Raptor	47	0.4668	1	0.1305
Waterfowl	4	0.0397	0	0
Water Bird	14	0.1390	1	0.1305
Other Bird	35	0.3476	3	0.3916
Passerine	194	1.9268	15	1.9582
Unknown bird spp.	1	0.0099	0	0
Subtotal Bird Species	**295**	**2.9299**	**20**	**2.6109**
Bat Species	90	0.8939	0	0
Subtotal Bat Species	**90**	**0.8939**	**0**	**0**
Grand Total	**385**	**3.8238**	**20**	**2.6109**

4.2.1 Shiloh I Chi-square Analysis of Incidents at Towers Adjacent to Meteorological Towers

We conducted chi-square tests for independence for the number of bird incidents (all species) detected at turbines adjacent to meteorological towers versus non-adjacent turbines at Shiloh I.

We found no significant deviation from the expected number of bird incidents between turbines adjacent vs. turbines not adjacent to meteorological towers (Yates[1] $\chi^2 = 0.03$, $df = 1$, P = 0.86, ns).

Table 21. Contingency table showing the proportion of bird incidents at turbines adjacent to meteorological towers vs. non-adjacent turbines at Shiloh I.

	# turbines	**# Bird Incidents**	**Sum**
Met_Adj Turbines	4	19	23
Not Adjacent	46	206	252
Sum	50	225	275

1 The expected frequency was less than 5 in more than 20% of the contingency test cells, necessitating the use of Yates' correction.

The monitoring of the met towers shows that guyed met towers are not without impact but the impact is not biologically significant and no threatened or endangered species were involved. Guyed met towers are generally replace by free-standing met towers once the project becomes operational and are, therefore, a temporary installation. It is our judgment that enough data has been gathered to provide the county a basis for determining its policies regarding these structures and no further studies are needed.

APPENDIX A. SHILOH II METEOROLOGICAL TOWER CARCASS SURVEY DATA SHEET

Page ____ of ____

Date_____ Observers _____
Notes:_____

Loc	Time		Fatalities		Ground Cover/Crop Type (give % cover, ave. height, whether standing or cut crop)						Weather			
Turb#	Start	Finish	#	Brief Notes	Gravel	Tilled	Wheat	Barley	Saff.	Fallow	Temp F	Wind Speed	Dir	% Cloud

APPENDIX B. SHILOH II WILDLIFE INCIDENT REPORT DATA SHEET.

SHILOH II

Wildlife Incident Report

SECTION NO. 1 - DISCOVERY DATA

Report Date: _____ Recovery Date: _____ ID#: _____

Reporting Crew: _____ Injury / Fatality Complete / Dismembered / Feathers / Bones

SECTION NO. 2 - LOCATION OF FIND

Parts: Bearing and Distance from tower/pole: Structure: _____

List parts by size:	Distance	Degrees
Part 1: _____	_____	_____
Part 2: _____	_____	_____
Part 3: _____	_____	_____

Location Remarks: _____
_____

SECTION NO. 3 - WILDLIFE IDENTIFICATION

Species: _____ Field marks used: _____

Age: _____ Sex: _____ Band: No ___ Yes ___ Unknown ___ (Leg(s) missing)

SECTION NO. 4 - OBSERVATIONAL DATA

Describe the physical condition of the find at the time of discovery:
_____
_____
_____

Describe Scavenging Activity: _____
Estimated Time Since Death or Injury (days): <1, <4, <7, <14, <30, >30, UNK Photos: _____

Carcass Condition:
____ 1 - Fresh
____ 2 - Decomposing (early stage)
____ 3 - Decomposing (late stage)
____ 4 - Desiccated
____ 5 - N/A

Infestation Activity: ____ Yes ____ No
____ Fly Larvae (maggots)_____
____ Adult Flies _____
____ Beetles_____
____ Ants_____
____ Other_____

Eyes: __N/A __Round, Fluid Filled __Partially Dehydrated __Flat __Sunken __Amorphous/Empty

Other Field Notes: _____
_____

APPENDIX C. LIST OF 51 INCIDENTS FOUND DURING STANDARDIZED SURVEYS AT TEMPORARY METEOROLOGICAL TOWERS S AT SHILOH II, FEBRUARY 22, 2006-APRIL 29, 2008.

ID#	Report Date	Estimated Month Death	Species Name	Species Group	Met Tower	Dist (m)	Deg (GN)*	Days Since Death
SHII-15-06	12/23/2006	Dec-06	American Pipit	Passerine	734	10	349	7
SHII-21-07	10/18/2007	Oct-07	American Pipit	Passerine	733	24	0	7
SHII-25-07	10/26/2007	Oct-07	American Pipit	Passerine	735	39	116	7
SHII-29-07	11/24/2007	Nov-07	American Pipit	Passerine	739	10	357	4
SHII-11-07	5/21/2007	May-07	Barn Owl	Raptor	740	27	116	7
SHII-02-07	1/28/2007	Jan-07	Brewer's Blackbird	Passerine	736	48	246	7
SHII-05-07	2/5/2007	Jan-07	Brewer's Blackbird	Passerine	733	27	22	7
SHII-22-07	10/18/2007	Oct-07	Brewer's Blackbird	Passerine	737	43	76	7
SHII-14-06	12/11/2006	Dec-06	Common Moorhen	Water Bird	733	31	300	7
SHII-23-07	10/26/2007	Oct-07	Dark-eyed Junco	Passerine	733	14	276	4
SHII-33-08	2/6/2008	Jan-08	European Starling	Passerine	736	32	54	7
SHII-03-07	1/28/2007	Jan-07	Horned Lark	Passerine	735	22	144	7
SHII-06-07	2/13/2007	Feb-07	Horned Lark	Passerine	733	14	100	7
SHII-09-07	5/14/2007	May-07	Horned Lark	Passerine	733	17	162	7
SHII-13-06	10/22/2006	Oct-06	Horned Lark	Passerine	739	24	206	4
SHII-14-07	7/18/2007	Jul-07	Horned Lark	Passerine	739	16	318	7
SHII-35-08	2/6/2008	Jan-08	Horned Lark	Passerine	732	39	2	7
SHII-38-08	3/1/2008	Feb-08	Killdeer	Water Bird	733	18	358	7
SHII-04-06	5/27/2006	May-06	Mourning Dove	Other Bird	739	26	77	7
SHII-07-06	7/22/2006	Jul-06	Mourning Dove	Other Bird	733	52	124	7
SHII-12-07	6/18/2007	Jun-07	Mourning Dove	Other Bird	737	19	348	7
SHII-18-07	7/30/2007	Jul-07	Mourning Dove	Other Bird	736	17	28	7
SHII-28-07	11/14/2007	Nov-07	Mourning Dove	Other Bird	738	42	156	7
SHII-32-08	2/6/2008	Jan-08	Mourning Dove	Other Bird	724	27	334	7
SHII-20-07	9/14/2007	Sep-07	Pacific-slope Flycatcher	Passerine	724	10	114	4
SHII-01-07	1/21/2007	Jan-07	Red-winged Blackbird	Passerine	735	41	160	7
SHII-05-06	6/25/2006	Jun-06	Red-winged Blackbird	Passerine	736	41	244	7
SHII-06-06	7/16/2006	Jul-06	Red-winged Blackbird	Passerine	738	44	88	7
SHII-07-07	2/27/2007	Feb-07	Red-winged Blackbird	Passerine	739	38	246	7
SHII-08-06	8/5/2006	Aug-06	Red-winged Blackbird	Passerine	733	28	224	4
SHII-10-06	9/17/2006	Sep-06	Red-winged Blackbird	Passerine	738	35	184	7
SHII-11-06	10/11/2006	Oct-06	Red-winged Blackbird	Passerine	738	22	4	7
SHII-31-07	12/5/2007	Nov-07	Red-winged Blackbird	Passerine	738	51	104	7
SHII-39-08	4/11/2008	Apr-08	Red-winged Blackbird	Passerine	732	42	14	7
SHII-01-06	3/8/2006	Mar-06	Rock Pigeon	Other Bird	735	16	204	4
SHII-03-06	5/14/2006	May-06	Rock Pigeon	Other Bird	735	20	92	4
SHII-13-07	7/2/2007	Jun-07	Rock Pigeon	Other Bird	735	42	74	7
SHII-19-07	8/20/2007	Aug-07	Rock Pigeon	Other Bird	736	22	350	7
SHII-30-07	12/1/2007	Nov-07	Rock Pigeon	Other Bird	737	36	4	7
SHII-36-08	2/23/2008	Feb-08	Rock Pigeon	Other Bird	737	20	254	7
SHII-37-08	2/23/2008	Feb-08	Rock Pigeon	Other Bird	735	46	352	7
SHII-02-06	3/8/2006	Mar-06	Savannah Sparrow	Passerine	733	16	74	1
SHII-26-07	10/26/2007	Oct-07	Savannah Sparrow	Passerine	735	31	70	7
SHII-27-07	11/14/2007	Nov-07	Savannah Sparrow	Passerine	739	19	6	7

SHII-10-07	5/21/2007	May-07	Unidentified Sparrow	Passerine	739	38	236	7
SHII-04-07	2/5/2007	Jan-07	Western Meadowlark	Passerine	733	52	80	7
SHII-08-07	4/30/2007	Apr-07	Western Meadowlark	Passerine	733	33	246	7
SHII-09-06	9/3/2006	Aug-06	Western Meadowlark	Passerine	733	37	100	7
SHII-12-06	10/11/2006	Oct-06	Western Meadowlark	Passerine	739	37	168	7
SHII-34-08	2/6/2008	Jan-08	Western Meadowlark	Passerine	732	29	60	7
SHII-24-07	10/26/2007	Oct-07	White-crowned Sparrow	Passerine	739	19	128	7

* Degrees Geographic North represents degrees from tower to carcass.

APPENDIX D. LIST OF 3 INCIDENTS FOUND INCIDENTALLY AT TEMPORARY METEOROLOGICAL TOWERS S AT SHILOH II, FEBRUARY 22, 2006 - APRIL 29, 2008.

ID#	Report Date	Estimated Month Death	Species Name	Species Group	Met Tower	Dist (m)	Deg (GN)*	Days Since Death
SHII-15-07	7/23/2007	Jul-07	Red-tailed Hawk	Raptor	738	90	114	7
SHII-16-07	7/23/2007	Jul-07	Brewer's Blackbird	Passerine	738	90	114	7
SHII-17-07	7/23/2007	Jul-07	Western Meadowlark	Passerine	738	90	114	7

- Degrees Geographic North represents degrees from tower to carcass.