FINAL ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED ISSUANCE OF AN EAGLE INCIDENTAL TAKE PERMIT FOR THE STERLING WIND PROJECT

Prepared for

U.S. FISH AND WILDLIFE SERVICE
Southwest Region
U.S. Department of Interior

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LIST OF ACRONYMS

AEM	AEM Wind, LLC
APLIC	Avian Power Line Interaction Committee
BBCS	Bird Bat Conservation Strategy
BCR	Bird Conservation Region
dBA	A-weighted-decibel
DDT	Dichloro-Diphenyl-Trichloroethane
EA	Environmental Assessment
ECP	Eagle Conservation Plan
EIS	Environmental Impact Statement
EMU	Eagle Management Unit
ESA	Endangered Species Act
GPS	Global Positioning System
ha	Hectare
ITP	Incidental Take Permit
km	Kilometer
kV	Kilovolt
LAP	Local Area Population
LCEC	Lea County Electric Cooperative
m	Meter
MW	Megawatt
NEPA	National Environmental Policy Act
NMDGF	New Mexico Department of Game and Fish
PEIS	Programmatic Environmental Impact Statement
USFWS	United States Fish and Wildlife Service

1 INTRODUCTION

This Environmental Assessment (EA) has been prepared to analyze the potential environmental impacts of the United States Fish and Wildlife Service (USFWS) issuing a 30-year incidental take permit (ITP) for golden eagles (*Aquila chrysaetos*) associated with the operation of the Sterling Wind Project pursuant to the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] §§ 4321–4347). Issuance of an ITP by the USFWS for take that is incidental to otherwise lawful activities under the Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C. §§ 668–668d and 50 Code of Federal Regulations [CFR] § 22.26) constitutes a discretionary Federal action that is subject to NEPA. This EA assists the USFWS in ensuring compliance with the NEPA, and in deciding as to whether any "significant" impacts could result from the analyzed actions that would require preparation of an Environmental Impact Statement (EIS). This EA evaluates the effects of alternatives for our decision whether to issue an eagle ITP.

The Eagle Act authorizes the USFWS to issue ITPs only when the take is compatible with the preservation of each eagle species, defined (in USFWS 2016a) as "consistent with the goals of maintaining stable or increasing breeding populations in all eagle management units (EMU) and the persistence of local populations throughout the geographic range of each species."

The applicant, AEM Wind, LLC (AEM), is requesting Eagle Act take coverage for operation activities associated with the Sterling Wind Project (Project). This company is an affiliate of Akuo Energy USA (Akuo Energy). The applicant has requested a 30-year ITP for golden eagles under the Eagle Act at the Sterling Wind Project located in Tatum, New Mexico. The applicant's Eagle Conservation Plan (ECP) (Appendix B) is the foundation of the permit application for the Project.

The applicant is requesting a permit for the take of 3 golden eagles over the 30-year life of the Project. This EA evaluates whether issuance of the eagle ITP will have significant impacts on the existing human environment. "Significance" under NEPA is defined by regulation at 40 CFR 1508.27, and requires short- and long-term consideration of both the context of a proposal and its intensity.

This proposal conforms with, and carries out, the management approach analyzed in, and adopted subsequent to, the USFWS's Programmatic Environmental Impact Statement (PEIS) for the Eagle Rule Revision, December 2016 (USFWS 2016a). Project-specific information not considered in the PEIS (USFWS 2016a) will be considered in this EA as described below.

Based on this project-specific analysis and application of the criteria provided in the PEIS, it has been determined that an EA is the appropriate level of review.

2 PURPOSE AND NEED

The need for this action is a decision on a proposed 30-year eagle ITP application from AEM. The decision must comply with all applicable regulatory requirements and be compatible with the preservation of eagles.

2.1 AUTHORITIES

USFWS authorities are codified under multiple statutes that address management and conservation of natural resources from many perspectives, including, but not limited to the effects of land, water, and energy development on fish, wildlife, plants, and their habitats. This analysis is based on the Eagle Act (16 U.S.C. 668–668e) and its regulations (50 CFR Part 22). The PEIS (USFWS 2016a) has a full list of authorities that apply to this action (PEIS Section 1.6, pages 7-12), which are incorporated by reference here.

2.2 BACKGROUND

The Project is on private lands approximately 8 kilometers (km) (5 miles) north of the city of Tatum, New Mexico (Figure 1). The Project employs 13 General Electric GE 2.3-116 turbines to produce approximately 30 megawatts (MW) of electricity.

Based solely on the preliminary screening information, the initial assessment determined that nesting habitat for eagles was absent in the project or surrounding regional area. With the exception of Carlsbad Caverns National Park, the southeastern portion of the state has been generally excluded from the breeding distribution for golden eagles (Kochert et al. 2002). No known nests are located within 161 km (100 miles) of the project area (Bob Murphy, USFWS, personal communication, July 26, 2016) and Lea County is considered a non-breeding distribution area for both eagle species (Cartron 2010). However, golden eagles are known to disperse through southeastern New Mexico in the winter (R. Murphy, USFWS, personal communication, July 26, 2016).

Avian point counts were conducted in the project area by Ecosystem Management, Inc. from March 2009 to February 2010 (Ecosystem Management, Inc. 2010). The point counts were completed using the variable circular plot methods as described by Reynolds et al. (1980) with 12 observations stations and an 800-meter (m) (2,625-foot) radius circle centered on each point. Winter raptor surveys were initiated on 5 days during the 2010–2011 season at 20 points (Ecology and Environment, Inc. 2012). SWCA Environmental Consultants (SWCA) conducted 26 days of additional surveys, specifically focused on golden eagles and other raptors, beginning in September 2015 and ending in March 2016 (SWCA 2016a). All of these surveys were designed to cover the original project area of 8,910 hectares (ha) (22,000 acres), which overlapped the final footprint area of 2,023 ha (5,000 acres).

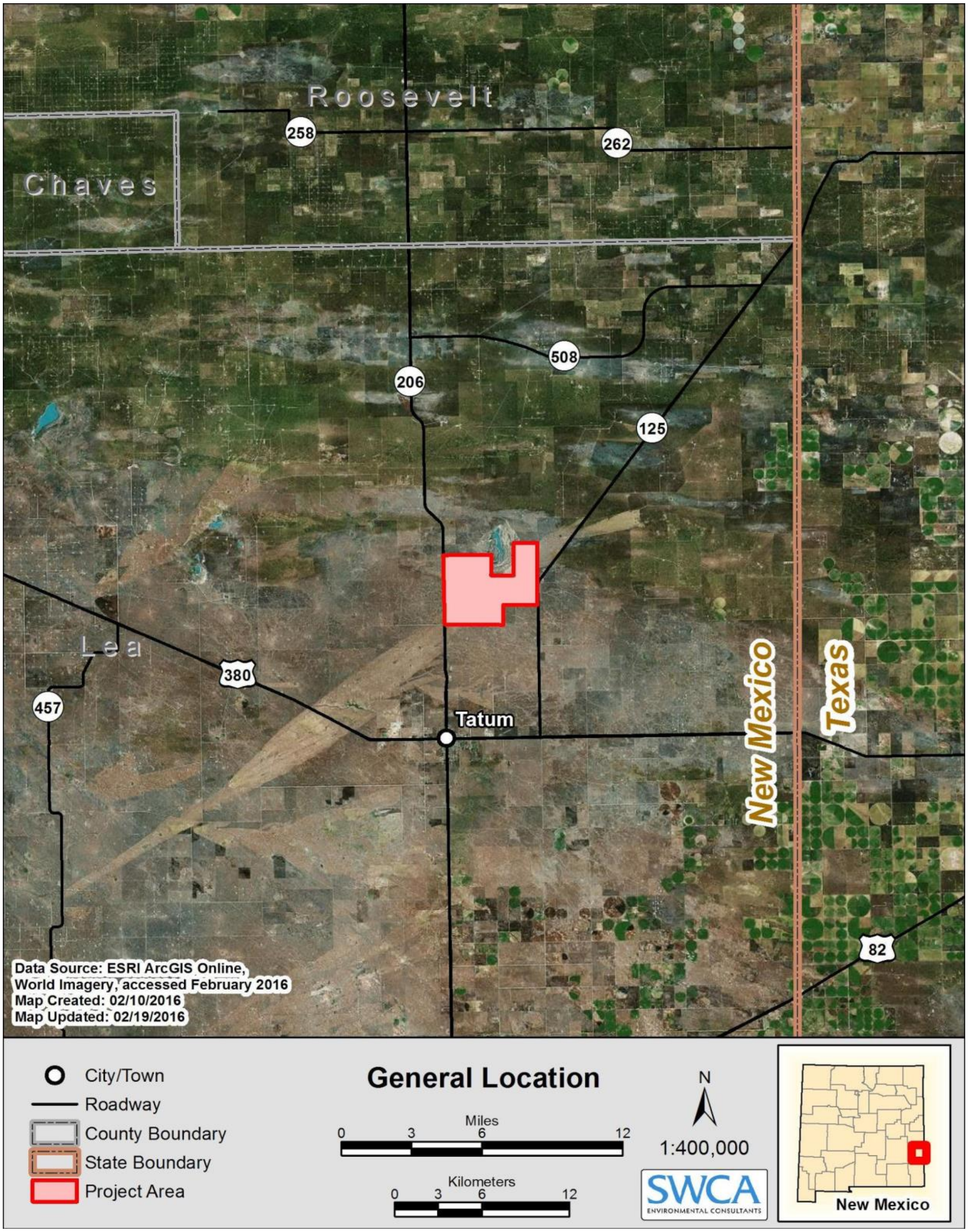

Figure 1. Sterling Wind Project Location Map

Avian surveys conducted in 2009–2010 (Ecosystem Management, Inc. 2010) recorded golden eagles in the original project area (22,000 acres). A single observation occurred in both the spring and fall, but the majority of sightings (6) were in the winter. Winter surveys completed in December, January, and February 2010–2011 also observed golden eagles in the western and south-central portion of the original project area (Ecology and Environment, Inc. 2012).

During the 2015–2016 avian surveys by SWCA, no golden eagles were observed in the original project area, but a juvenile golden eagle was regularly observed along U.S. Highway 380, 16 km (10 miles) west-southwest of the current project area (SWCA 2016a). Data from tagged juvenile golden eagles in the fall of 2011 and fall/winter 2015-2016 showed a similar preference for the area south and west of the Project (See Appendix A). The juvenile eagle present in 2011 made infrequent flights through or to the original project area. This eagle was later determined to have been killed by electrocution along a distribution line west of Tatum, New Mexico.

Fatality estimates presented in the ECP analysis were derived from a combination of 15-minute, 30-minute, and 1-hour survey periods due to the difference in methods used in the three survey periods. The Draft USFWS Collision Fatality Model Code, Version 3 (January 11, 2013), updated with new priors from the April 2013 ECP Guidance to predict annual eagle fatality from the survey data, was used to produce a mean estimate of fatality (i.e., mean among many model iterations) and 50%, 80%, 90%, and 95% upper credible intervals around the estimate. Model runs were completed by SWCA for the draft ECP and subsequently by the USFWS for the final draft (see Appendix A, section 7.1). For a 5-year evaluation estimate, the eagle fatality rate was rounded up to one eagle to estimate compensatory mitigation.

In the December 2016 USFWS revision of the Eagle Rule, the basis for the local area population (LAP) scale for golden eagles was reduced to a 175-km (109-mile) buffer, stemming from new information on natal dispersal distance and an improved analysis (USFWS 2016a). Deriving density estimates from bird conservation regions (BCR) that overlap the buffered area, the LAP was estimated at 285 golden eagles (USFWS Cumulative Effects Tool, run April 17, 2019). The Project’s estimated annual take of 0.099 golden eagles equated to 0.03% of the estimated LAP. The 5% benchmark was calculated as 14 golden eagles annually. Based on this analysis, the 0.099 annual mortality rate for the Project represented 0.7% of this benchmark, well below either the 1% or 5% benchmarks.

2.3 Scoping, Consulting, and Coordination

Considerable communication occurred between AEM and the USFWS prior to construction of the Project. AEM initiated communication with the USFWS New Mexico Ecological Services Field Office, the USFWS Region 2 Division of Migratory Birds, and the New Mexico Department of Game and Fish (NMDGF) regarding this Project in April 2011. Regular meetings and other communication have subsequently occurred with the USFWS and are summarized in the meeting notes in the BBCS (Appendix A).

Florian Chevrollier and Tom Cote of AEM and Pete David met with Bob Murphy and Jennifer Davis (with USFWS) on April 11, 2016 to discuss the results of the Bird and Bat Conservation Strategy (BBCS) and eagle fatality model, the status of the ECP, and the proposed post-construction monitoring. There was general agreement that the Project would represent a low-end Category 2 risk to eagles. The meeting notes are included in the BBCS of this document's Appendix A.

A BBCS draft was submitted to Jennifer Davis in May 2016. A draft ECP was submitted to Bob Murphy in May 2017. Comments from Bob Murphy were received in June 2017. A final revised ECP was submitted to Corrie Borgman (with USFWS) in July 2017.

As summarized above, AEM worked closely with the USFWS and subsequently coordinated with Lea County Electric Cooperative (LCEC) to implement compensatory mitigation measures (SWCA 2017). As their consultant, Pete David coordinated with Bob Murphy (previously with USFWS) and LCEC to develop an acceptable (to the USFWS and LCEC) retrofitting plan (Appendix C) that would support AEM's application to avoid, minimize, and mitigate adverse effects on eagles.

This EA incorporates by reference the scoping performed for the PEIS (Chapter 6, page 175).

2.4 Tribal Coordination

Tribal pre-construction communication was initiated by AEM in April 2016 with letters sent to Ysleta del Sur Pueblo, Comanche Nation of Oklahoma, Apache Tribe of Oklahoma, and Kiowa Tribe of Oklahoma. Responses were received from the first two tribes declaring no objections to the pending development. A copy of the sample letter is included in Appendix D.

A Cultural Class III archeological survey was completed in September 2016 and found no artifacts or sites eligible by the Historic Preservation Division or National Register of Historic Places located within 1,000 m of the project area (SWCA 2016b).

As required by the Advisory Council on Historic Preservation Regulations' Protection of Historic Properties (36 CFR 800) for implementing Section 106 of the National Historic Preservation Act, the USFWS conducted consultation with tribes in 2013 and 2014 regarding national eagle management and permitting actions, including revising eagle rule regulations. The results of this consultation are summarized in the PEIS (Section 6.22) and are incorporated by reference.

On January 30, 2019, the USFWS emailed and mailed an information handout and a letter to all Tribes within the Southwest Region, providing details on the Project, the regulatory process, and informing them that the Draft EA would be posted to the Migratory Bird Program Permits NEPA Reviews webpage. On February 14, 2019, the USFWS released the Draft EA for public comment, identifying two alternatives, including the preferred alternative. The Draft EA was available for 45 days and it was posted on the Region 2 Migratory Bird Program Permits NEPA Reviews webpage. The USFWS received responses to the Draft EA from the four Tribes listed below indicating no concerns.

- Choctaw Nation of Oklahoma
- Pawnee Nation of Oklahoma
- Pueblo of Santa Ana
- Pascua Yaqui Tribe

3 PROPOSED ACTION AND ALTERNATIVES

The following section summarizes the Proposed Action and Alternatives.

3.1 PROPOSED ACTION

The Proposed Action is for the USFWS to issue a 30-year ITP to take up to three golden eagles with associated conditions, as allowed by regulation. The applicant will implement the conservation commitments described in the applicant's ECP (Appendix B). These include the monthly monitoring of all turbines during the first year and monthly monitoring of all turbines during October through March of the second year. The second-year monitoring corresponds to the period when eagles are present in the area. In addition, although no hunting occurs on the private property where the Project is located, AEM staff have and will continue to be instructed to look for large animal carcasses, including cows (that might attract eagles) while traveling through the site. All large mammal carcasses identified will be reported to the site manager within 8 hours and removed from the site within 48 hours of notification. Near the end of the second year of monitoring, AEM will have a Worker Education Awareness Program presented to site staff to reinforce commitments made in the ECP including the implementation of an internal monitoring program that will be used by on-site project personnel to record eagle fatalities over the long-term duration of operation. During the initial 2 years of monitoring, personnel were instructed not to collect dead birds without notifying a contact person. However, at the end of the 2-year monitoring period, personnel will again be instructed not to collect any dead birds. Personnel will be trained to identify a golden eagle, should a fatality occur, and instructed to report it within 24 hours to the consultant and the USWFS.

3.2 ALTERNATIVE 1: NO ACTION

Under the No-Action Alternative, USFWS would take no further action on AEM's permit application. In reality, the USFWS must act on the permit application, determining whether to deny or issue the permit. This is considered an alternative because USFWS policy requires evaluation of a No-Action Alternative and it provides a clear comparison of any potential effects to the human environment from the Proposed Action.

The No-Action Alternative in this context analyzes predictable outcomes of the USFWS not issuing a permit. Under the No-Action Alternative, the Project would continue to operate without an ITP being issued, and none of the conservation measures proposed in the eagle ITP application would be required. Thus, for purposes of analyzing the No-Action Alternative, USFWS assumes that the applicant will implement all measures required by other agencies and jurisdictions to conduct the activity at this site, but the conservation measures proposed in the ITP application package would not be required. The project proponent would choose to implement some, none, or all of those conservation measures. In fact, AEM had a retrofitting plan completed to guide compensatory mitigation as proposed in the ECP, which consisted of the modification of 65 power poles and transformers in an area included in the same BCR. Bob Murphy (previously of USFWS) reviewed the plan and it was agreed that 78 power line retrofits (including two transformers) would be completed by LCEC (R. Murphy, USFWS, personal communication by e-mail, July 7, 2017). This number included the 65 calculated by the Resource Equivalency Analysis model analysis in the ECP, adjusted for the 1.2:1 ratio as required by the December 2016 Eagle Rule Revision. Under this alternative, the applicant has already performed the necessary compensatory mitigation for the taking of one eagle, but will not have legal protection from enforcement for violating the Eagle Act should take of an eagle occur. This alternative would meet the Purpose and Need since AEM would comply with all applicable regulatory requirements and these actions would be compatible with the preservation of eagles.

3.3 OTHER ALTERNATIVES CONSIDERED BUT NOT EVALUATED IN THIS ENVIRONMENTAL ASSESSMENT

The USFWS considered alternatives but concluded that these alternatives did not meet the Purpose and Need underlying the action because they were not consistent with the Eagle Act and its regulations. Therefore, the USFWS did not assess the potential environmental impacts of those alternatives. Below is a summary of the other alternative considered but eliminated from further review.

3.3.1 ALTERNATIVE 2: DENY PERMIT

Under this alternative, the USFWS would deny the permit application because the applicant falls under one of the disqualifying factors and circumstances denoted in 50 CFR 13.21 or the application fails to meet all regulatory permit issuance criteria and required determinations listed in 50 CFR 22.26.

Permit issuance regulations at 50 CFR 13.21(b) set forth a variety of circumstances that disqualify an applicant from obtaining a permit. None of the disqualifying factors or circumstances denoted in 50 CFR 13.21 apply to AEM. Further consideration consisted of whether the applicant meets all issuance criteria for the type of permit being issued. For eagle ITPs, those issuance criteria are found in § 22.26(f). AEM’s application meets all the regulatory issuance criteria and required determinations (50 CFR 22.26) for an ITP.

When an applicant for an eagle ITP is not disqualified under 50 CFR 13.21 and meets all the issuance criteria of 50 CFR 22.26, denial of the permit is not a reasonable option. Therefore, this alternative—denial of the permit—was eliminated from further consideration.

4 AFFECTED ENVIRONMENT

This section describes the current status of the environmental resources and values that are affected by the Proposed Action and Alternatives.

4.1 ENVIRONMENTAL SETTING

Ownership of land within the project area boundary is designated as unincorporated private, with a single landowner. The land has never been developed and is currently used exclusively as grazing land for beef cattle. The land is located in the High Plains Arid Llano Estacado ecoregion characterized by grassland and shrubland. The natural shortgrass prairie vegetation for the region includes blue grama (*Bouteloua gracilis*), black grama (*B. eriopoda*), buffalograss (*B. dactyloides*), silver bluestem (*Bothriochloa saccharoides*), sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida* sp.), Arizona cottontop (*Digitaria californica*), hairy tridens (*Erioneuron pilosum*), muhly (*Muhlenbergia* sp.), bottlebrush squirreltail (*Elymus elymoides*), and sand sagebrush (*Artemisia filifolia*). Common shrubs include mesquite, narrowleaf yucca (*Yucca angustissima*), juniper (*Juniperus* sp.), and ephedra (*Ephedra* sp.). The major land use for the ecoregion is ranching and livestock grazing, oil and gas production, and a small amount of irrigated cotton, grain sorghum, and wheat (Griffith et al. 2006). The area would naturally support the Plains-Mesa Grassland community of east-central New Mexico as described by Dick-Peddie (1993).

4.2 BALD EAGLE

Bald eagles (*Haliaeetus leucocephalus*) may be observed throughout the year in New Mexico, but the majority of recorded sightings occurred during the winter. Although bald eagles winter in New Mexico, they are mostly confined to river systems or reservoirs (Hubbard et al. 1988). No breeding habitat is known in Lea County or any of the surrounding counties. No bald eagles were observed during avian surveys conducted in spring, fall, and winter of 2009-2010 (Ecosystem Management, Inc. 2010), winter of 2010-2011 (Ecology and Environment, Inc. 2012), or the period from September 2015 to March 2016 (SWCA 2017). Conversations with a raptor biologist who had access to state-wide breeding data indicated that no bald eagles were actively nesting within Lea County as of 2013 (Jean-Luc Cartron, personal communication, April 23, 2014). The NMDGF database (BISON-M) considers bald eagle occurrence in Lea County as rare (NMDGF 2018).

The project area was surveyed by SWCA for prairie dog colonies since they might attract bald eagles, and only one colony was found and it appeared to be limited to a few active burrows. None of the information reviewed for the BBCS or ECP identified the project area as an important corridor for bald eagle migration. The dearth of rivers or permanent bodies of water would make it highly unlikely bald eagles would be present in the project area during winter. The nearest permanent water is located at Bitter Lakes Wildlife Refuge and the Pecos River approximately 112 km (70 miles) to the west. Bald eagles were known to be an occasional visitor during the spring (March to May) and uncommon during the fall (September to November) and winter (December to February) at Grulla National Wildlife Refuge about 80 km (50 miles) north-northeast of the project area (USFWS 1994).

Known stressors on populations of bald eagles include shooting, habitat destruction, and the use of organochlorine pesticides such as dichloro-diphenyl-trichloroethane (DDT) after World War II (Henny and Anthony 1992). A ban on DDT in 1972 may have contributed to a population increase from fewer than 500 pairs in the 1960s to more than 4,000 pairs in 2005 (USFWS 2007). The bald eagle nesting population increased slightly in New Mexico between 2007 and 2012 (NMDGF 2016) as well as nationwide (USFWS 2016b). Current stressors on the population include habitat deterioration and human disturbance, but major sources of direct mortality include accidental trauma, poisoning, gunshot, and electrocutions (USFWS 2016a). The wintering population of this species grew steadily after the ban on DDT and it appears more recently that New Mexico continues to be an important wintering area (Cartron 2010). The greatest sources of mortality in New Mexico may be starvation and lead poisoning (Cartron 2010).

4.3 Golden Eagle

As with the bald eagle, conversations with a raptor biologist with access to state-wide breeding data indicated that no golden eagles were actively nesting within Lea County as of 2013 (Jean-Luc Cartron, personal communication, April 23, 2014). Kochert et al. (2002) noted that golden eagle breeding distribution excluded the extreme southeastern part of New Mexico, although nesting in Carlsbad Caverns National Park and the Guadalupe Mountains has been documented. Although southeastern New Mexico does not appear to contain an important breeding area, golden eagles are known to disperse through southeastern New Mexico in the winter (Bob Murphy, USFWS, personal communication, July 26, 2016). Scattered prairie dog colonies are present in the region that might attract eagles, but the project area and vicinity does not contain large concentrations of prey, although black-tailed jackrabbits (*Lepus californicus*), a preferred prey, are common. Regular observations by biologists of the prairie dog colony in the project area between 2014 and 2016 noted a general decline in the number of animals (SWCA 2016a). Recent surveys performed by SWCA in March 2016 detected only two active prairie dog burrows (SWCA 2016a). Golden eagles are known to scavenge carcasses in winter and pronghorn (*Antilocapra americana*) are abundant on the project and surrounding private land. However, the current landowner does not allow hunting and pronghorn tend to be reluctant to cross major highways or barbed wire fence lines that prevent pronghorn from passing underneath (Ockenfels et al. 1994). This avoidance would reduce the risk of their becoming victim to vehicle collisions, and thus providing carcasses that would attract eagles. Cattle are also present, although in low stocking rates, and they may provide an occasional carcass.

Avian surveys conducted in 2009–2010 (Ecosystem Management, Inc. 2010) recorded golden eagles in the original project area (22,000 acres). A single observation occurred in both the spring and fall, but the majority of sightings (6) were in the winter.

Winter surveys completed in December, January, and February 2010–2011 also observed golden eagles in the western and south-central portion of the original project area (Ecology and Environment, Inc. 2012). All the birds observed were juveniles or sub-adults and most were perched on power lines.

During the final year of avian surveys in 2015–2016, no golden eagles were observed in the original project area, but a juvenile golden eagle was regularly observed along U.S. Highway 380, 16 km (10 miles) west-southwest of the current project area. Data from the fall of 2011 and fall/winter 2015-2016 showed tagged juvenile golden eagles had a similar preference for the area south and west of the Project (see Figure 5.2, pages 17-18 in Section 5.1 of the ECP in Appendix B).

In the December 2016 USFWS revision of the Eagle Rule, the basis for the LAP scale for golden eagles was reduced to a 175-km (109-mile) buffer, stemming from new information on natal dispersal distance and an improved analysis (USFWS 2016b). Deriving density estimates from BCRs that overlap the buffered area, the USFWS generated a LAP size of 285 golden eagles encompassing the Sterling Wind Project. The Project lies primarily within the Shortgrass Prairie Bird Conservation Region. Analysis by Millsap et al. (2016) suggested that golden eagle populations in this BCR have been relatively stable for the last 43 years.

Jackrabbits and other Leporids represent a major prey item for golden eagles across the western U.S. (Bedrosian et al. 2017). Invasions of exotic plant species and alteration of fire frequencies have the potential to decrease the quality of shrubland habitat and could reduce prey populations across much of the west. Overall, as human activity and development increases throughout the west, associated pressures on golden eagle populations are also expected to increase (Good et al. 2009). Electrocution continues to be a concern for its impact on golden eagle populations (Millsap et al. 2016) and electrocution rates of golden eagles, especially for sub-adults continue to be high in some areas of the west where powerlines have not been retrofitted (Lehman et al. 2010). Starvation and or disease was the greatest mortality factor as determined from satellite-tagged golden eagles in the North America (Millsap et al. 2016). In New Mexico, current documented or suspected causes of mortality include electrocutions, collisions with turbine blades, and lead poisoning, although retrofitting of problem power poles continues to be encouraged as a compensatory mitigation technique to reduce eagle mortality (USFWS 2016a).

4.4 MIGRATORY BIRDS

Issuance of this permit may benefit other raptors such as red-tailed (*Buteo jamaicensis*), Swainson’s (*Buteo swainsonii*), and ferruginous hawks (*Buteo regalis*) that inhabit the area seasonally. These larger buteo species are vulnerable to electrocution either from nesting or perching on power poles, and their mortality from electrocution has been documented in numerous studies (APLIC 2006). Initial design and subsequent retrofitting to improve safety have been recognized as important practices to reduce electrocution risk to these species (APLIC 2006). Pre-construction surveys at the project area noted presence of the former two species during the breeding season and the presence of ferruginous hawks primarily during the winter (Ecosystem Management, Inc. 2010; Ecology and Environment, Inc. 2012).

Red-tailed hawks are year-round residents in New Mexico and have been recorded breeding near the project area (Akuo Energy 2011). A red-tailed hawk nest was reported in the original project area during a preliminary nesting survey (Akuo Energy 2011). Red-tailed hawks also migrate through New Mexico between more northern breeding grounds and wintering areas in Mexico and Central America (Cartron 2010). Birds also winter in New Mexico, primarily in the southwestern part of the state (Hubbard et al. 1988). Red-tailed hawks were observed during pre-construction surveys in spring, fall, and winter of 2009-2010, although in low numbers (Ecosystem Management, Inc. 2010), and only one bird was recorded in the 2010-2011 winter surveys (Ecology and Environment, Inc. 2012). Surveys in the fall and winter of 2015-2016 recorded only two sightings of red-tailed hawks (SWCA 2016b).

Swainson's hawks commonly breed in southeastern New Mexico including Lea County (Cartron et al. 2009) and nesting by this species in the original project area has been confirmed (Akuo Energy 2011). Cartron (2010) reported an estimated minimum and stable breeding population of 3,000 pairs in New Mexico, despite recent reports of high mortality rates on Argentinian wintering grounds (Goldstein et al. 1997). Some limited mortality from shooting and collisions has been reported (Cartron 2010), and the species has been observed as a victim of vehicle collision. This species has been recorded as a fatality at the Sterling Wind Project during post-construction monitoring and this level of mortality could affect success or survival of the local breeding population.

The nonbreeding distribution of ferruginous hawks in New Mexico is concentrated in the south and southeastern parts of the state (Cartron 2010). Breeding occurs in northern New Mexico, particularly in the northwest (Schwarz 2005). As noted above, ferruginous hawks were more commonly present in the fall and winter of 2009 and 2010 (Ecosystem Management, Inc. 2010) and were observed regularly in the project area during the winter of 2010-2011 (Ecology and Environment, Inc. 2012). Ferruginous hawks were recorded on surveys conducted between October and March of 2015 (SWCA 2016b). In New Mexico, nest disturbance and eradication of prairie dogs may have impacted ferruginous hawk populations (Cook et al. 2003). New Mexico's population appears stable (Cartron 2010), but threats to the population still include shooting, poaching, and power line strikes (Mikesic 2005), and the species may be particularly vulnerable to electrocutions (Cartron et al. 2006).

Other migratory birds occur in the area year-round, although summer and winter numbers and diversity tend to be low. Large numbers of long-billed curlews (*Numenius americanus*) have been observed in the project area during the fall (Ecosystem Management, Inc. 2010; SWCA 2016b). Horned larks (*Eremophilia alpestris*) are the most abundant winter resident in the project area (SWCA 2016b). Fall/winter surveys in 2015-2016 recorded 520 birds of 20 species (SWCA

2016a). Surveys conducted in spring, fall, and winter of 2009-2010 observed 45 bird species, with lark bunting (*Calamospiza melanocorys*) being the most numerous spring and fall migrant (Ecosystem Management, Inc. 2010). Although electrocutions primarily occur among larger birds, smaller sized species are also vulnerable where energized electrical components are spaced closer together on power lines and especially on transformers (USFWS 2018a). Birds can be electrocuted when landing on transformers and smaller migratory birds may be most vulnerable when attempting to nest on these structures (APLIC 2006).

4.5 Species Listed Under the Endangered Species Act

No species currently listed under the Endangered Species Act are expected to occur in the project area. The northern aplomado falcon (*Falco femoralis*) is the only species listed in the county as an experimental population and non-essential (USFWS 2018b). Habitat in most of the project area would be considered poor and unlikely to support breeding of this species. No federally-listed species were observed during any of the pre-construction surveys.

4.6 Cultural and Socio-economic Interests

Socio-economic conditions include employment and income, demographic trends, lifestyle and cultural values, community infrastructure, and environmental justice. As of 2010, the population of Tatum, New Mexico totaled 798, with whites comprising the majority (640) racial group (U.S. Census Bureau 2012a). A cultural or socio-economic impact from issuance of the permit is unlikely on minorities in the local population given they make up such a small percentage of the population. Similar results were obtained for the county, where whites account for 91.4% and Hispanics or Latinos account for 58.5% (U.S. Census Bureau 2012b). Native Americans and African Americans comprise only 1.9% and 4.4% of the county population, respectively (percentages exceed 100% due to multiple race and ethnic categories and due to rounding of percentages). The permit’s issuance would have no impact on human health and environmental conditions relative to minority or low-income communities.

Due to private ownership and the rural setting, no residences will be impacted by the operation of the Project. There are no nearby parks or natural areas providing public recreational opportunities that would be aesthetically impacted by the presence of the Project.

As a condition of the ECP and ITP submittal, AEM contributed approximately $22,600.00 to LCEC to perform retrofits on 78 power poles and transformers in Lea County. The funding supported the full-time employment of two electrical technicians from Lovington, New Mexico for a period of 2 months, thus contributing to the local economy. About 1% of that amount was spent by LCEC on transformer bushing covers, insulators, and line protectors to complete the retrofits.

4.7 Climate Change

Climate change was considered in the PEIS (USFWS 2016a; Section 3.9, page 144) and is incorporated by reference here.

5 ENVIRONMENTAL CONSEQUENCES

This section summarizes the effects on the environment of implementing the Proposed Action or Alternatives.

5.1 Bald Eagle

Under the No-Action Alternative, no temporary, permanent, or short- or long-term changes to bald eagle population or status would likely occur. Not issuing the permit could have a minor adverse impact on the population should a bald eagle be electrocuted by powerlines that would have been retrofitted as mitigation to prevent mortality of golden eagles. Since the presence of this species would be rare, the effects are anticipated to be negligible.

With the issuance of the permit under the Proposed Action, the 78 power pole and transformer retrofits could have a minor beneficial impact on bald eagles by reducing the likelihood of an electrocution should a bald eagle decide to use the retrofitted section of power line. Overall, since the presence of this species would be rare, the effects would be negligible.

5.2 Golden Eagle

The discussion of overall effects of the golden eagle ITP program is provided in the PEIS (USFWS 2016a) and is incorporated by reference here. This section of this EA analyzes only the effects that may result from the issuance of an eagle ITP for this specific Project.

Under the No-Action Alternative, retrofitting of the 78 power poles and transformers would not take place and therefore the risk for golden eagles to be electrocuted increases along one section of powerline in an area used by wintering eagles. This would result in potential temporary and minor adverse change to the golden eagle population by the loss most likely of a juvenile bird. Given the retrofitted section is a small portion of the many miles of power lines in southeastern New Mexico where golden eagles winter, the effect of the No-Action Alternative would not be considered significant.

With the issuance of the permit under the Proposed Action, the 78 power pole and transformer retrofits could have a minor beneficial effect on golden eagle population by reducing the likelihood of an electrocution should golden eagles use the retrofitted section of the power line. The loss of a potential breeding adult or a future breeding juvenile would be unlikely to have a significant impact on the population. Beneficial effects would be both direct (prevents bird fatality) and indirect (future breeding contribution by a juvenile to the population).

5.2.1 PROPOSED ACTION

In determining the significance of effects of the Project on golden eagles, the USFWS screened the Proposed Action against the analysis provided in the PEIS (USFWS 2016a) and the USFWS's 2016 report, "Bald and Golden Eagles: Status, trends, and estimation of sustainable take rates in the United States." The eagle-risk analysis and Cumulative Effects Analysis (USFWS 2013) were also used to quantify golden eagle fatality risk and cumulative local population level effects.

Under the Proposed Action, it is estimated that 0.099 golden eagles may be taken annually, and three eagles taken over the life of the permit (i.e., 30 years). This prediction is based on a conservative approach that is expected to overestimate annual and cumulative take at the outset of the permit. It is anticipated the prediction will decrease as project-specific monitoring data are incorporated into the prediction as part of the permit's adaptive management process. The first two years of post-construction monitoring have been completed and no eagle fatalities were recorded. Therefore, it is assumed that no adaptive management measures will be implemented at this time. As mitigation to fully offset the authorized take for the first 5-year permit review period, AEM completed 78 power pole and transformer retrofits, mitigating the loss of one eagle. The eagle fatality monitoring associated with this alternative (e.g., evaluating all turbines during one monitoring year plus a second winter season when eagles are present) will allow the USFWS and permittee to estimate the total number of annual eagle fatalities. Monitoring is a critical component of adaptive management to avoid significant impacts to golden eagles. In addition, a Worker Environmental Awareness Program was completed on April 11, 2019 for the current Sterling Wind staff to explain their responsibilities for future internal monitoring and to ensure they can identify a golden eagle should a fatality occur.

Take of golden eagles has the potential to affect the larger eagle population. Accordingly, the 2016 PEIS analyzed the cumulative effects of permitting take of golden eagles in combination with ongoing unauthorized sources of human-caused eagle mortality and other present or foreseeable future actions affecting golden eagle populations. As part of the analysis, the USFWS determined sustainable limits to permitted take within each EMU. The take that would be authorized by this permit will be offset by the compensatory mitigation that will be provided by the applicant, so it will not significantly impact the EMU eagle population. The avoidance and minimization measures that would be required under the permit, along with the additional adaptive management measures, are designed to further ensure that the permit is compatible with the preservation of the golden eagle at the regional EMU population scale.

Additionally, to ensure that golden eagle populations at the local scale are not depleted by cumulative take in the local area, the USFWS analyzed in the PEIS (USFWS 2016a) the amount of take that can be authorized while still maintaining LAP of golden eagles. To issue a permit, cumulative authorized take must not exceed 5% of a LAP unless the USFWS can demonstrate why allowing take to exceed that limit is still compatible with the preservation of golden eagles. The eagle ITP regulations require USFWS to conduct an individual LAP analysis for each permit application as part of our application review.

Cumulative effects to the LAP surrounding the Sterling Wind Project were considered to evaluate whether the take to be authorized under this permit, together with other sources of permitted take and unpermitted eagle mortality, may be incompatible with the persistence of the Project LAP. The USFWS incorporated data provided by the applicant, data on other eagle take authorized and permitted by the USFWS, and other reliably documented unauthorized eagle mortalities to estimate cumulative impacts to the LAP. A cumulative effects analysis was conducted as described in the USFWS's ECP Guidance (USFWS 2013).

In the December 2016 USFWS revision of the Eagle Rule, the basis for the LAP scale for golden eagles was reduced to a 175-km (109-mile) buffer, stemming from new information on natal dispersal distance and an improved analysis (USFWS 2016a). Deriving density estimates from BCRs that overlap the buffered area and encompass the Sterling Wind Project area, the USFWS generated a LAP size of 285 golden eagles. The Project's estimated annual take of 0.099 golden eagles would equate to 0.03% of the estimated LAP. The 5% benchmark would be 14 golden eagles annually. Based on this analysis, the 0.099 annual mortality rate for the Sterling Wind Project would only represent 0.7% of this benchmark.

The take that would be authorized by this permit for the Sterling Wind Project does not exceed 5% of the LAP and any take would be offset by the compensatory mitigation that will be provided by the applicant, so local area golden eagle populations will not be significantly impacted by issuance of the permit.

5.2.2 ALTERNATIVE 1 : NO ACTION

Even though the USFWS would take no action on the permit application under the No-Action Alternative, the Project would likely continue to operate without authorization for take of golden eagles. Should take of eagles occur under the No-Action Alternative, the applicant would be in violation of the Eagle Act. Because no measures would be implemented to avoid or minimize risk to eagles under this No-Action Alternative, the risk to eagles is expected to be higher under this alternative as compared to the Proposed Action. Under this alternative, direct impacts on the golden eagle population over the 30-year life of the Sterling Wind Project are anticipated to be the loss of three eagles (0.099 eagles per year over 30 years). Should take exceed that level the impacts to golden eagles would not be offset by compensatory mitigation.

This alternative does not meet the Purpose and Need for the action because, by regulation (50 CFR 13.21), when in receipt of a completed application, the USFWS must either issue or deny a permit to the applicant. The No-Action Alternative also does not meet the Purpose and Need for the action because it would result in the adverse, unmitigated effects described above that are not compatible with the preservation of golden eagles.

5.2.3 COMPARISON OF EFFECTS OF EACH ALTERNATIVE

Table 5.1 compares the effects of the Proposed Action and Alternative(s) for golden eagles.

Table 5.1. Summary and Comparison of Effects of each Alternative

Effect	Proposed Action - ITP	Alternative 1 - No Action
Eagle Take Levels	3 eagles over 30 years	3 eagles over 30 years
Avoidance and Minimization	No additional avoidance or minimization proposed beyond what has been completed relative to the ECP	None required
Compensatory Mitigation	Retrofitting of 78 power poles and transformers	None provided
Unmitigated Eagle Take	Zero	Up to 3 eagles over 30 years
Data Collected by USFWS	Annual post-construction monitoring report after year 1, and final post-construction monitoring report after year 2. After year 2 and staff training, internal monitoring for eagle fatalities.	None
Company Liability for Eagle Take	None (if in compliance with permit conditions)	Yes

5.3 Migratory Birds

Under the No-Action Alternative, temporary short-term adverse changes to migratory bird populations or status have the potential to occur. Not issuing the permit could have a minor adverse impact on the local Swainson’s hawk population should one be electrocuted by powerlines that would have been retrofitted as mitigation to prevent mortality of golden eagles. Since the presence of this hawk species is common during the breeding season, a fatality of an adult bird could potentially affect the productivity of a local nesting effort. Since juvenile birds may be more vulnerable to electrocution (APLIC 2006), the loss of young birds could have a minor adverse effect on future birds returning to the area to breed. In terms of local hawk populations, the effects are not anticipated to be significant.

Under the No-Action Alternative, not issuing the permit could have a minor short-term adverse impact to ferruginous hawk populations since this species winters in southern New Mexico (Eakle et al. 1996) and has been consistently observed in the project area during this season (Ecosystem Management, Inc. 2010; Ecology and Environment, Inc. 2012; SWCA 2016b). Although this species does not breed in the area, winter survival would influence birds being available to nest the following year. Loss of breeding adults could impact subsequent breeding success. Under this alternative, not performing retrofits increases the potential for a ferruginous hawk fatality by electrocution although in terms of overall species population, the effects are not anticipated to be significant. Beneficial effects would be both direct (prevents bird fatality) and indirect (future breeding success).

Under the No-Action Alternative, not performing retrofits increases the potential for a red-tailed hawk fatality by electrocution but, given the bird is not common in the area, the effects are anticipated to be negligible in terms of impacts to the overall species population.

Under the No-Action Alternative, temporary short-term negative impacts to breeding migratory birds would occur since the electrocution risk to birds that attempt to nest in transformers along the section of line where retrofitting would be performed would not be removed. However, the small number of transformers to be retrofitted would result in a negligible effect on migratory bird populations.

With the issuance of the permit under the Proposed Action, the 78 power pole and transformer retrofits could have a minor beneficial impact on Swainson’s hawks by reducing the likelihood of electrocutions. Since these hawks are common breeders in southeastern New Mexico and this powerline section represents a small section for retrofitting, it is not anticipated that the overall effects would be significant. Issuance of the permit under the Proposed Action could also have a minor beneficial effect on ferruginous hawks, and to a lesser degree red-tailed hawks, by reducing the potential for electrocution on a short section of power line to be retrofitted. Beneficial effects would be both direct (prevents bird fatality) and indirect (future breeding success).

With the issuance of the permit under the Proposed Action, the 78 power pole and transformer retrofits provide a benefit by reducing the electrocution risk to all migratory birds. However, given the small number of transformers to be retrofitted it is likely to result in a negligible effect on migratory bird populations.

5.4 Species Listed Under the Endangered Species Act

Under the No-Action Alternative, no effects are anticipated for federally listed species since they are unlikely to be present in the Project Area.

Issuance of the permit under the Proposed Action would have no effects on federally listed species since they are unlikely to be present in the Project Area.

5.5 Cultural and Socio-economic Interests

Issuance of the permit under the Proposed Action is not likely to result in temporary, permanent, or short- or long-term changes to human health and environmental conditions relative to minority or low-income communities.

5.6 Climate Change

Climate change was considered in the PEIS (USFWS 2016a; Section 3.9, page 144) and is incorporated by reference here. In general, the Proposed Action would have no direct impact on climate change. However; the operation of the Project would offset the need for the burning of fossil fuels and provide a minor benefit to reducing climate change.

6 EVALUATION OF CUMULATIVE EFFECTS

Cumulative effects for resource categories on a national scale have been thoroughly discussed in Chapter 4 of the PEIS (USFWS 2016a). For the discussion in this EA, cumulative effects will be assessed relative to the issuance of an ITP for the 175-km (109-mile) area corresponding to the LAP of golden eagles, rather than using EMUs or BCRs. This analysis area is deemed appropriate given that it represents several BCRs and covers a majority of southeastern New Mexico and western Texas where golden eagles spend the winter, but is an area where breeding is rare. In addition, although EMUs correspond to migratory movement of eagles, it would seem logical that they are more at risk when they are present for an extended period of time where wind projects are operating.

6.1 Bald Eagle

Bald eagles were dismissed from the cumulative effects analysis due to their rare occurrence in the Project Area.

6.2 Golden Eagle

For the evaluation of cumulative effects in the PEIS for golden eagles, twelve sources of mortality were reviewed for permits involving “disturbance take” and limited “take resulting in mortality.” However, the Proposed Action in this EA is the issuance of a permit authorizing take. The issuance of this permit to allow take in itself does not necessarily result in mortality of an eagle, but the cumulative mortality from multiple factors may result in the USFWS re-evaluating the take threshold. The following analysis will examine regional (175-km [109-mile]) causes of potential golden eagle take over the next 30 years (i.e., life of the permit) comparable to those discussed in the PEIS for the U.S.

Deriving density estimates from BCRs that overlap the buffered area and encompass the Sterling Wind Project area, the USFWS generated a LAP size of 285 golden eagles. The LAP 5% benchmark for authorized take would be 14 golden eagles annually. For the wintering area in southeastern New Mexico, a number of the mortality factors identified in the PEIS are less likely to impact eagle populations. The area is primarily rangeland with little agriculture that would promote the use of chemicals resulting in poisoning. Some hunting occurs for pronghorn, but no hunting is allowed on the project area, and the number of animals killed is small and more widely distributed compared to other areas where ungulate densities are higher and lead poisoning would be a greater threat. Few pronghorn are killed on highways, which reduces the potential for eagles to be killed by collisions with vehicles while feeding on a carcass. In addition, poaching, trapping, and collisions with aircraft do not appear to be common mortality factors in this part of the country (Cartron 2010).

Long-term, the majority of this area will continue to be best suited for rangeland, and significant habitat loss and fragmentation is not anticipated in the next 30 years. Energy production has already encroached throughout Lea County and although oil and gas exploration and development will continue, the long-term prediction is that it will not be sustained. This energy development is cyclic, contingent upon the price of oil which regularly fluctuates. Frequent collapses in oil prices slows production, although it is impossible to predict when these will occur or when production will begin to wane, with the expansion of other energy sources.

Drought associated with climate change could affect golden eagle populations in this region by reducing winter prey availability, although it is unlikely that the effects will be evident in the next 30 years. Precipitation in this part of the desert southwest is not consistent and short-term drought periods are common. These cycles don't appear to be affecting continued use of this area by wintering golden eagles.

Renewable energy and associated power lines could have a cumulative impact on golden eagles over the next 30 years. Golden eagle electrocutions have been well documented throughout their range (Franson et al. 1995), and at least one radio-tagged juvenile was killed in 2011 at a distribution line in the analysis area (Bob Murphy, personal communication, April 2017). Since mortality data from electrocutions are not readily available and data from post-construction monitoring are confidential, the actual number of fatalities cannot be determined.

As of 2016, there are 11 wind projects or 872 MW of wind energy within the analysis radius. At this time, no eagle take permits have been issued and no other applications are pending with the USFWS. It is anticipated that the number of renewable energy projects, primarily those focused on wind will increase considerably in the analysis region during the next 30 years. Evaluating wind resource maps provides an indication as to the potential for further wind development within this radius. Wind resources in eastern New Mexico and western Texas assure potential for future development (AWEA 2015). Additional projects are proposed in western Texas that would be in the analysis radius, including Mesquite Creek (200 MW), Stephens Ranch (211 MW), and Fiber Winds (80 MW). The likelihood of golden eagle mortality may be greater in Texas with the larger number of turbines and the presence of increased number of wintering golden eagles.

Additional projects proposed in the analysis area of New Mexico include Xcel Energy's potential development of the Bonita project in Cochran County, Texas (200 MW) to be commercially operational in 2019 and the Sagamore Wind project in Roosevelt County, New Mexico that could add up to another 522 MW and be operational by 2020 as the state's largest wind farm (Xcel Energy 2018a). It is not known at this time whether any of these projects will apply for eagle take permits, but their development will increase the risk of eagle fatalities.

In addition, Xcel Energy is in the process of building nearly 643 km (400 miles) of 115 kilovolt (kV) to 345 kV power lines in southeastern New Mexico over the next several years (Xcel Energy 2018b). More structures or upgrades are likely over the next 30 years to accommodate increased energy production. However, it is assumed that through the permitting process these new structures will adhere closely to meeting Avian Power Line Interaction Committee (APLIC) standards and will not increase the cumulative potential for eagle electrocution mortality.

Issuance of the eagle ITP for the Sterling Wind Project will result in the retrofitting of 78 power poles and transformers for the first 5-year review period. At this time, no other proposed wind projects in the analysis region have obtained eagle take permits or have applied for one. It is not known if projects proposed as described above or other future development will apply for permits. However, if permit applications are submitted, the resulting retrofits will have a beneficial cumulative impact on the golden eagle population since modifying extensive sections of high-risk powerlines will contribute to reducing eagle fatalities from electrocution.

6.3 MIGRATORY BIRDS

The analysis of cumulative effects on migratory birds is similar to that for golden eagles. The potential increase in wind projects over the next 30 years will have a cumulative impact on migratory bird populations as discussed above. The addition of power lines may increase the potential for collisions depending on where the lines are located and whether or not they are co-located with other lines or marked to improve visibility. In general, if power lines are designed and constructed according to APLIC guidelines, no significant increase in mortality associated with electrocutions or collisions is likely.

Wind energy facility infrastructure alters the landscape characteristics through placement of tall structures (towers and transmission lines) and road networks. Possible threats from these features include behavioral avoidance and auditory and visual disturbance (USFWS 2012). The displacement of grassland bird species in response to wind energy development may be species-specific and the displacement response of individual species has been inconsistently observed (American Wind Wildlife Institute 2015).

Wind projects characteristically remove only a small percentage of the surrounding grassland habitat. These areas tend to have low diversity and density of breeding species and similar rangeland habitat is common throughout the analysis area. Therefore, future wind energy development is unlikely to have a significant effect on breeding migratory species. The effects may also be temporary and confined to the construction area as breeding birds become acclimated to the operation noise. Modern turbines have noise levels near or below the 49-A-weighted-decibel (dBA) threshold known to impact breeding birds (Inglefinger 2001). American Wind Energy Association (2009) documentation indicates that current turbine noise levels are between 35 and 45 dBA at 350 m (1,150 feet) (i.e., noise level similar to background noise in most homes).

Cumulative impacts to Swainson's hawks may be particularly problematic with the expansion of wind energy development since this species has been documented with fatalities at the Sterling Wind and other projects in the analysis area. Depending on the degree of increased wind energy development over the next 30 years, there is potential for an impact on the population of this species due to its preference to nest in rangeland habitat (Groen 2015).

Retrofits associated with additional eagle take permits will have a cumulative beneficial impact on migratory birds by reducing risk of mortality from electrocutions. It is unknown at this time how many projects will apply for permits or whether the USFWS will initiate a process for migratory bird take permits in the next 30 years. In addition, improvements to both wind and solar project development technology may make infrastructure less of a mortality risk to wildlife.

6.4 Species Listed Under the Endangered Species Act

Federally listed species were dismissed from the cumulative effects analysis due to their rare occurrence in the Project Area.

6.5 Cultural and Socio-Economic Interests

Due to the need for large open spaces, wind development has generally occurred on large privately-owned ranch land and it is not anticipated this trend would change in the next 5 or 30 years. In addition, no concentrations of minority or low-income populations are present in the analysis area. Therefore, the permit's issuance combined with future energy development is not likely to have a cumulative impact on human health and environmental conditions relative to minority or low-income communities.

The issuance of future eagle take permits would have a positive cumulative impact by generating revenue from the retrofitting of power pole and transformers. Currently, the wind projects proposed for future development are considerably larger than the Sterling Wind Project, which would result in significantly more revenue to local utilities to support employee salaries. This assumes these projects apply for permits and are required to perform comparable compensatory mitigation.

6.6 Climate Change

In general, the issuance of future permits relative to wind projects and other renewable energy development in the analysis area would reduce or offset the need for fossil fuels and have a cumulative positive impact on reducing the effects of climate change.

7 MITIGATION AND MONITORING

The Proposed Action incorporates measures to minimize and avoid to the maximum degree practicable impacts to golden eagles, as required by regulation. To ensure that regional eagle populations are maintained consistent with the preservation standard, regulations require that any golden eagle take that cannot practicably be avoided and is above EMU take limits must be offset by compensatory mitigation at a 1.2 to 1 ratio. As golden eagle take limits for all EMUs were determined to be zero (USFWS 2016b), compensatory mitigation was necessary to offset any authorized take of golden eagles. Mitigation measures as previously described above in the Proposed Action section were completed.

AEM has completed two years of post-construction monitoring for eagle fatalities using independent, third-party monitors that have submitted reports directly to the USFWS. Beginning in 2019, Sterling Wind staff will implement an internal monitoring program for golden eagle fatalities. Monitoring consisted of monthly carcass searches for all 13 turbines using transects spaced at 10-m (33-foot) intervals. Search plot size was 140 m width, centered on the turbine mast, which covered the height of the turbines at the facility from the ground to the top height of the turbine blade as recommended by Strickland et al. (2011). Data collected for each carcass included species, age, sex, estimated time since death, condition, type of injury, cover type, global positioning system (GPS) coordinates, distance to nearest wind turbine generator location, distance to nearest road, and distance to nearest structure. All observed carcasses were photo-documented and identified to the lowest taxonomic level possible using photographs, field notes, and relevant scientific references.

Searcher efficiency studies were conducted to quantify searcher bias. The results of these studies were used to develop correction factors to estimate adjusted fatalities for the Project and for each surveyed turbine, as appropriate. Searcher efficiency rates were expressed as the proportion of study carcasses detected by searchers in the searcher efficiency studies. These rates were grouped by carcass size and season for the adjusted fatality estimate.

Separate searcher efficiency rates were determined for the following three categories:

- Bats
- Large birds, defined here as
    - raptors (Falconiformes [diurnal birds of prey] and vultures);
    - waterfowl (Anseriformes, or ducks, geese, and swans); and
    - water birds (bitterns, herons, egrets, ibises, and cranes)
- Small birds (non-large bird species, primarily passerines)

Searcher efficiency studies were completed during the winter to account for different field conditions that may have affected the ability of the surveyors to locate carcasses. However, the range conditions were relatively stable due to the grazing pressure, which would provide consistently good visibility for large bird carcasses.

Carcass removal studies were performed to document the length of time carcasses remained in the surveyed area and available to be found by searchers, and to determine the appropriate frequency of carcass searches for turbine-associated fatalities within the search plots. Carcass removal studies were completed for two seasons (spring-summer and winter) and concurrently with the winter searcher efficiency studies described above.

Carcasses were placed as described for searcher efficiency studies. They were checked on days 1–4, 7, 14, and 28 following placement or until they were all removed. Separate carcass removal rates were determined for bats, small birds (passerines), and large birds (raptors).

The mean carcass removal rate was derived from the carcass removal studies and used to adjust the search interval. Estimates of the probability that a carcass was not removed in the time between surveys and therefore was available to be found by searchers was used to adjust carcass counts for removal bias (Huso et al. 2012).

After the initial year of carcass surveys, a second year of surveys was completed corresponding to the winter months when golden eagles were present (i.e., October through March).

After the second season of monitoring, an internal monitoring program will be initiated in 2019 following the worker education awareness program administered by the third-party consultant. Consultants briefed all contractors, project operations staff, and other personnel who would be on-site on a regular basis to conduct visual surveys for golden eagle fatalities.

With the issuance of the permit, the USFWS will require 1-2 years of independent, third-party monitoring (i.e., standardized carcass searches, searcher efficiency trials, and carcass removal trials) every five years, depending on results from the previous five-year review period.

At 5-year intervals, the USFWS will review the eagle fatality data and other pertinent information, provided by independent third-party monitors, as well as information provided by AEM through their internal monitoring to assess whether AEM has complied with the terms and conditions of the permit and has implemented all applicable measures specified in the permit to ensure eagle take has not exceeded the amount authorized within that time frame. The USFWS will update fatality predictions, authorized take levels, and compensatory mitigation, as needed, for future years of the permit.

If authorized take levels for the period of review are exceeded in a manner or to a degree not addressed in the adaptive management conditions of the permit, based on the observed levels of take using approved protocols for monitoring and estimating total take, the USFWS may require additional actions including but not limited to: adding, removing, or adjusting avoidance, minimization, or compensatory mitigation measures; modifying adaptive management conditions; modifying monitoring requirements; and suspending or revoking the permit.

The mitigation, fatality monitoring, and adaptive management required under the permit will effectively offset impacts to golden eagles, and therefore those effects will not be significant.

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APPENDIX A
BIRD AND BAT CONSERVATION STRATEGY

Bird and Bat Conservation Strategy for the Sterling Wind Project, Lea County, New Mexico

Prepared for

AEM Wind, LLC

Prepared by

SWCA Environmental Consultants

Revised by
Hawkpoint Environmental Consulting

April 2016, Revised April 2019

BIRD AND BAT CONSERVATION STRATEGY FOR THE STERLING WIND PROJECT, LEA COUNTY, NEW MEXICO

Prepared for

AEM Wind, LLC

Prepared by

SWCA ENVIRONMENTAL CONSULTANTS
SWCA Project No. 31526

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April 2019

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1 STATEMENT OF PURPOSE

AEM Wind, LLC (AEM) is committed to siting, constructing, operating, and decommissioning the Sterling Wind Project (project) in an environmentally responsible and sustainable manner. As a subsidiary of Akuo Energy USA, Inc., AEM maintains the same dedication to environmental protection. AEM practices environmental stewardship at all stages of project development and will continue to collaborate closely with environmental agencies in order to develop appropriate measures to reduce wildlife impacts. This environmental responsibility includes conserving and minimizing impacts to natural resources, including avian and bat species and their habitat. This Bird and bat Conservation Strategy (BBCS) has been prepared in adherence with the voluntary guidelines outlined in the U.S. Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (USFWS 2012a, 2013)

This BBCS represents a framework for voluntary actions that can be implemented to conserve birds and bats during the planning, construction, operation, maintenance, and decommissioning of the project to be constructed in Lea County, New Mexico. This document outlines the steps AEM has taken and plans to take to avoid, minimize, and mitigate project-related impacts to birds and bats.

2 REGULATORY FRAMEWORK

2.1 MIGRATORY BIRD TREATY ACT

The regulatory framework for protecting birds includes the Migratory Bird Treaty Act (MBTA) and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). The MBTA is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation. The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill . . . possess, offer for sale, sell . . . purchase . . . ship, export, import . . . transport or cause to be transported . . . any migratory bird, any part, nest, or eggs of any such bird" (16 United States Code [USC] 703). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 Code of Federal Regulations [CFR] 10.12). The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes more than 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. Currently, no authority exists under the MBTA for permitting incidental take associated with a wind project.

2.2 BALD AND GOLDEN EAGLE PROTECTION ACT

The Bald and Golden Eagle Protection Act (BGEPA) specifically protects bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*). Under authority of the

BGEPA (16 USC 668–668d), bald and golden eagles are afforded additional legal protection. The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, transport, export, or import, at any time or in any manner, of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof (16 USC 668). The act also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 USC 668c), and includes criminal and civil penalties for violating the statute (see 16 USC 668). The term "disturb" is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (50 CFR 22.3).

On September 11, 2009, the USFWS established two new permit types under the BGEPA: 1) permits for take of bald and golden eagles that are associated with, but not the purpose of, the activity (50 CFR 22.26) and 2) permits for purposeful take of an active or inactive eagle nest where necessary to alleviate a safety emergency, an inactive eagle nest when the removal is necessary to ensure public health and safety, an inactive nest that is built on a human-engineered structure and creates a functional hazard that renders the structure inoperable for its intended use, or an inactive nest, provided the take is necessary to protect an interest in a particular locality and the activity necessitating the take or the mitigation for the take will, with reasonable certainty, provide a clear and substantial benefit to eagles (50 CFR 22.27).

The USFWS developed a new process in 2016 for issuing permits for take of bald and golden eagles at wind energy facilities (USFWS 2016) and recommends that project proponents prepare a BBCS to avoid, minimize, or otherwise mitigate project-related impacts to birds and bats.

2.3 Endangered Species Act

The Endangered Species Act (ESA) directs the USFWS to identify and protect endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. Among its other provisions, the ESA requires the USFWS to assess civil and criminal penalties for violations of the ESA or its regulations. Section 9 of the ESA prohibits take of federally listed species. Take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" (16 USC 1532). The term "harm" includes significant habitat alteration that kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Projects involving federal lands, funding, or authorizations will require consultation between the federal agency and the USFWS, pursuant to Section 7 of the ESA.

2.4 Other Laws, Regulations, and Policies

2.4.1 New Mexico Department of Game and Fish

The Wildlife Conservation Act (17-2-37 through 17-2-46 New Mexico Statutes Annotated 1978) provides the New Mexico Department of Game and Fish (NMDGF) the authority and responsibility to protect, manage, and conserve species of wildlife indigenous to the state. The legislature directed the NMDGF to manage, maintain, or—to the extent possible—enhance numbers of species found to be threatened or endangered within the carrying capacity of the habitat.

A summary of the distribution, current status, threats (existing, past, or future actions that can create uncertainty of species persistence if they are not carried out in a manner that considers wildlife and habitat needs), and recommendations regarding listing status and conservation actions are presented for each species or subspecies on the state's biennial review. The most recent review was issued in October 2018 (NMDGF 2018). In addition to those federally listed species above, five bird species the state has designated as threatened or endangered have the potential to occur in Lea County (see Appendix A).

2.4.2 LEA COUNTY

Lea County does not have any county-level wildlife or environmental regulations.

2.4.3 LAND-BASED WIND ENERGY GUIDELINES

Concern regarding the impact of wind development on environmental resources during both short-term construction and long-term operation prompted the USFWS to issue its voluntary interim guidelines in 2003. These guidelines advised developers on recommended methods to assess, develop, and site their projects to reduce adverse effects on environmental resources, particularly fish and wildlife. In 2007, the Wind Turbine Guidelines Federal Advisory Committee was established by the USFWS to review and make recommendations going forward on improvements to the interim guidelines. The committee's final recommendations, submitted in 2010, were subsequently used by the USFWS to develop a new set of voluntary guidelines for public comment and review, resulting in the release of the draft *Land-Based Wind Energy Guidelines* in July 2011. Following additional revisions, a final version was released on March 23, 2012.

The *Final Land-Based Wind Energy Guidelines* outlines recommended measures to avoid or minimize impacts to wildlife and their habitats from wind energy facilities. They also encourage reviewing agencies and other professionals to complete a tiered analysis to determine impacts and design avoidance and minimization strategies. There are five tiers, representing different levels of analysis, to be implemented as needed:

- **Tier 1:** Preliminary site evaluation, including landscape-level assessment and literature review
- **Tier 2:** Site characterization, including potential presence of species of concern
- **Tier 3:** Field studies and impact prediction
- **Tier 4:** Post-construction (operational) studies to estimate impacts
- **Tier 5:** Other post-construction studies and research

The key laws, regulations, and guidelines described above have been closely followed in order to develop the project study design and the conservation measures to protect birds and bats during construction and operation. Furthermore, the guidelines issued by the USFWS, including the *Final Land-Based Wind Energy Guidelines*, have been used to critically evaluate the project for potential impacts to birds and bats at each level of development.

3 PROJECT DESCRIPTION

AEM, a wholly-owned subsidiary of Akuo Energy USA, Inc., is proposing to develop a 30-megawatt (MW) wind facility in Lea County, New Mexico. The wind project will be located on 2,025 ha (5,000 acres) of private lands approximately 8 km (5 miles north) of the city of Tatum (Figure 3.1). The project will consist of 13 General Electric (GE) 2.3-116 turbines (80-m [262.5-foot] hub height, 56.9-m [186.7-foot] blade), a new 0.2-ha (0.5-acre) substation, nearly 7.3 km (4.5 miles) of new roads, 12.7 km (7.8 miles) of collection lines, and three meteorological towers (Figure 3.2). Construction of the project will require standard wind farm construction activities, including

- road and pad development;
- construction of foundation and footings for turbine towers;
- trenching for collector line installation;
- tower assembly, erection, and equipment installation;
- final road grading;
- implementing erosion control; and
- site clean-up.

The turbines will be placed in one east-west-oriented row, accessed by gravel and dirt roads. AEM will construct, own, and operate a substation at the site in order to step up the power generation and facilitate the interconnection.

Where necessary, ranch roads will be improved by adding a mix of caliche and aggregates, and possible cement for stabilization. The roads will be 4.8 m (16 feet) wide with 3.0 m (10 feet) of compacted shoulders to accommodate cranes and other large equipment. The new access roads will be left in place, but the shoulders degraded and reseeded.

Crane pads will be approximately 40 × 20 m (131 × 66 feet) at each turbine location. The pads will be 18 to 30.5 m (60–100 feet) in diameter, with a 6-m (20-foot) radius of permanent gravel; the remainder will be reseeded.

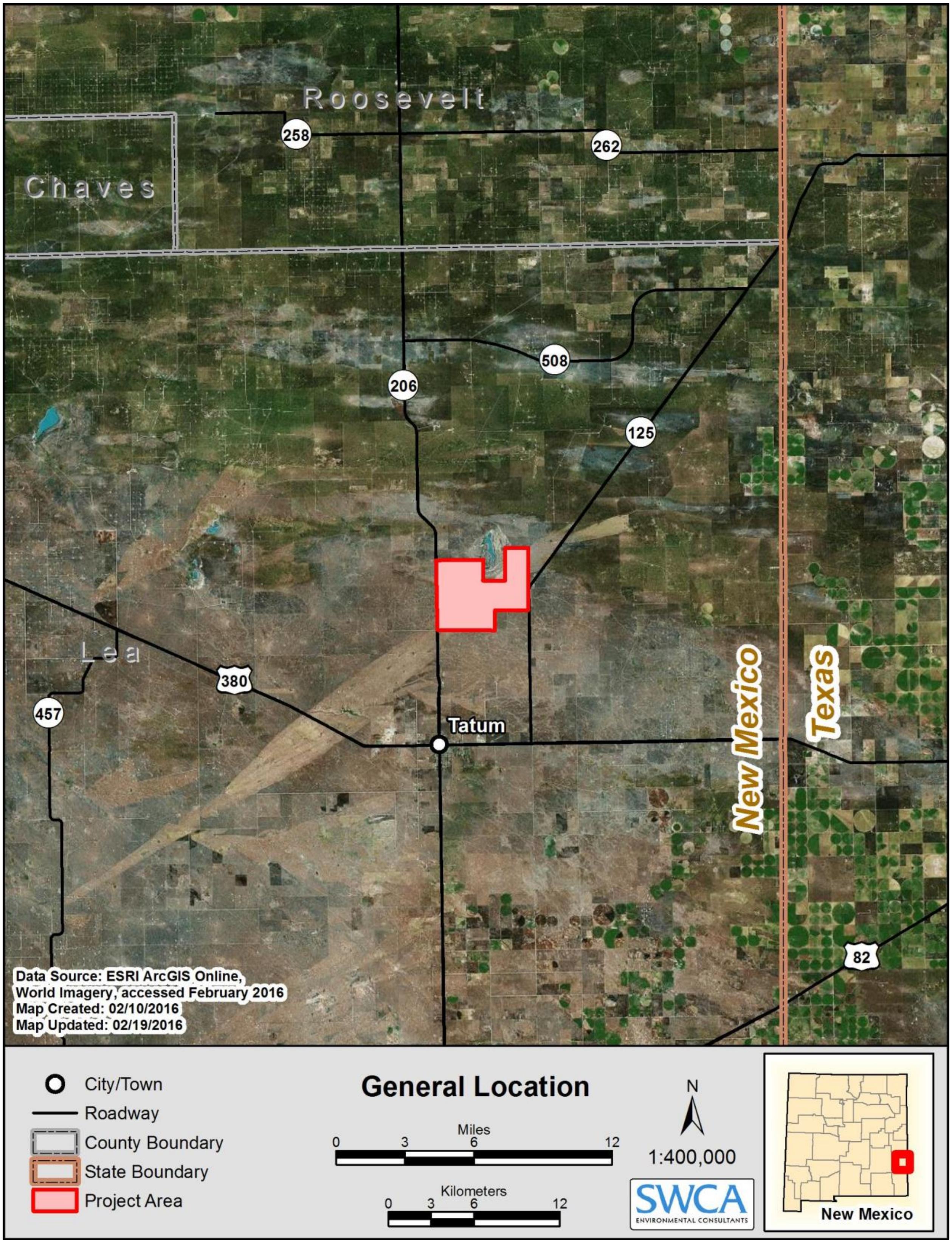

Figure 3.1. Sterling Wind Project location map.

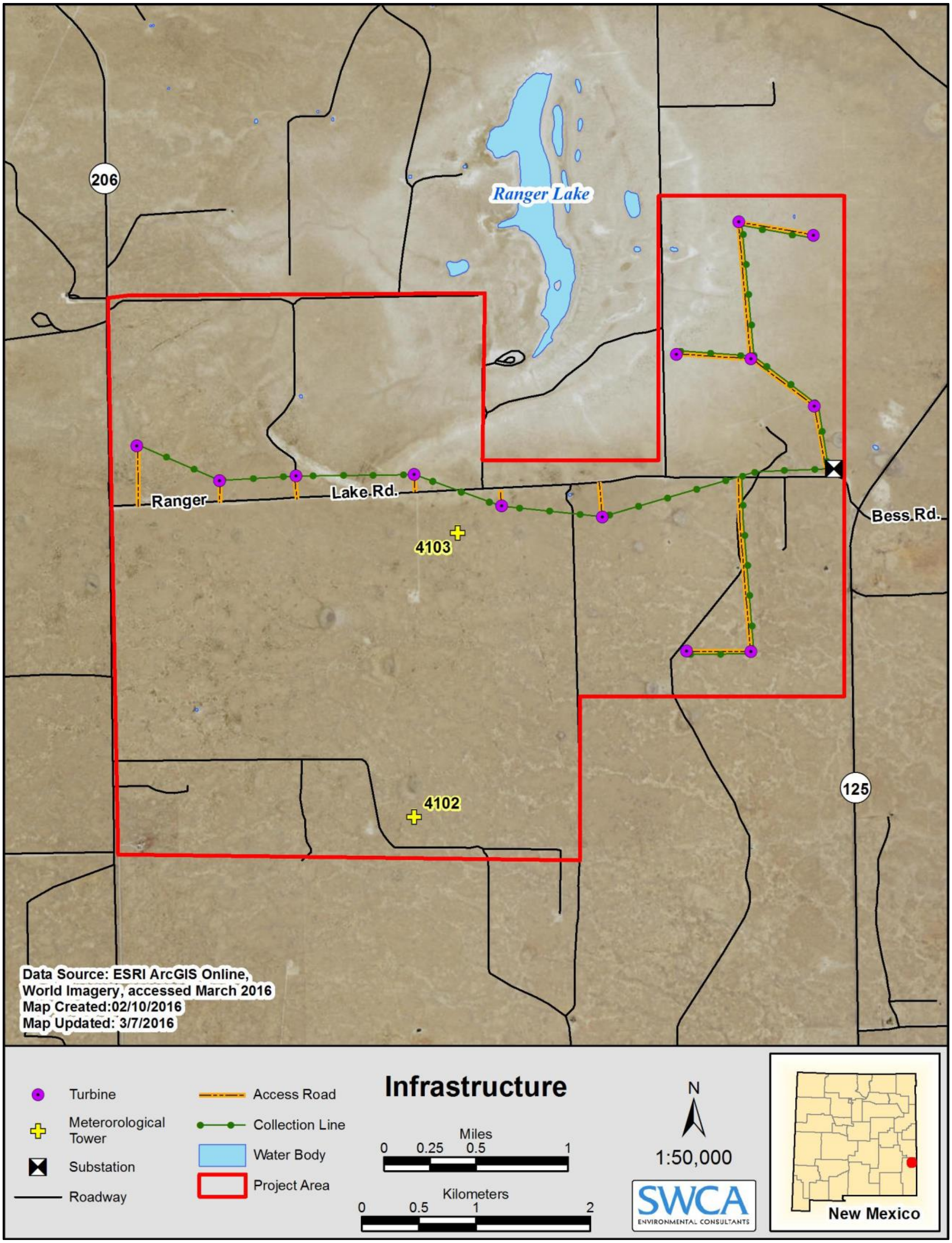

Figure 3.2. Sterling Wind Project infrastructure.

4 PROJECT HISTORY OF BIRD AND BAT PRESENCE AND RISK ASSESSMENT

4.1 PRELIMINARY SITE EVALUATION (WIND ENERGY GUIDELINES TIER 1)

Following the typical AEM development process, once a site has been chosen based on the quality of the wind resource, land acquisition potential, and transmission capacity analysis, a critical issues analysis is conducted to assess the environmental setting, natural resources, and wildlife located at the site. If no fatal flaws are discovered at this stage, the analysis findings are used to establish a series of targeted environmental assessments to be conducted at the site.

The information collected during these surveys is then applied to AEM's meticulous site design process to maximize the production of the development, while simultaneously minimizing all negative environmental and cultural impacts to the greatest extent practicable.

A critical issues analysis was conducted on a 10,935-ha (27,000-acre) area by Ecology and Environment, Inc. (2008). In addition to the desktop study, the area was field surveyed on January 24, 2008. The survey area encompassed all possible turbine placement areas, as well as collection line, substation, and access road areas. The analysis recommended winter and breeding raptor surveys and lek surveys for lesser prairie-chicken (*Tympanuchus pallidicinctus*).

Based on a combination of commercial requirements (wind resource, transmission, and power purchase agreement availability) and regional environmental review, the area was selected for development. The project area was reduced to 8,598 ha (21,229 acres) and subsequently to the current size of 2,025 ha (5,000 acres) (Figure 4.1).

4.1.1 CONSULTATION HISTORY

AEM initiated communication with the USFWS New Mexico Ecological Services Field Office, the USFWS Region 2 Division of Migratory Birds, and the NMDGF regarding this project in April 2011. Prior to the meeting, AEM provided the USFWS with the project description, endangered species assessment table, critical issues analysis, and avian baseline report. The meeting was attended by the USFWS's Laila Lienesch, Bob Murphy, and Chris O'Meilia. USFWS staff raised a concern about the presence of prairie dogs (*Cynomys* sp.) and suggested AEM contact Jim Stuart (NMDGF). USFWS staff also recommended additional winter surveys be conducted at fixed points and of longer duration. The USFWS also recommended AEM document nesting raptors at the site and develop a project Avian and Bat Protection Plan (ABPP). AEM subsequently contacted Mr. Stuart on May 3, 2011. Mr. Stuart responded with an e-mail on May 6, 2011, stating he was unaware of any prairie dog colonies in the project area.

AEM sent a separate letter to the NMDGF requesting comments on the proposed project. AEM received a review letter from Rachel Jankowitz (previously with the NMDGF) dated May 6, 2011. The letter asked for additional information on habitat and avian resources, including raptors, lesser prairie-chicken and long-billed curlew (*Numenius americanus*). AEM responded in a May 16, 2011, letter to Ms. Jankowitz with an updated summary of survey data collected.

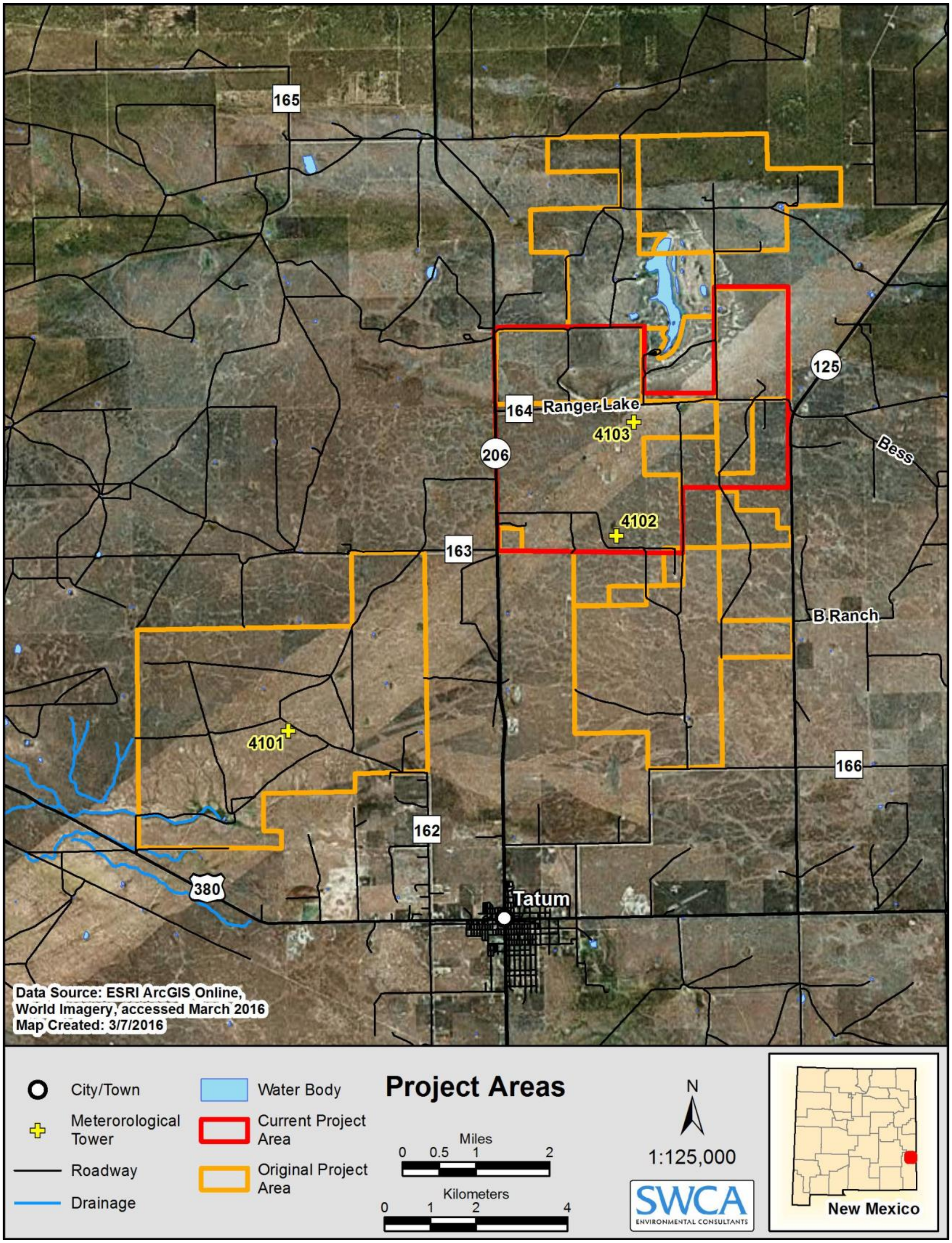

Figure 4.1. Original and current project areas.

On May 8, AEM conducted a nesting survey of the project area. A summary of the survey was sent to Laila Lienesch and Rachel Jankowitz on July 7, 2011.

An ABPP was submitted to Laila Lienesch (USFWS) on August 29, 2012. AEM requested a review of the proposed project in order to determine the best course for proceeding in environmental compliance.

Through further discussions with Bob Murphy, it was decided that AEM would produce an Eagle Conservation Plan (ECP) in addition to the ABPP (now a BBCS). A draft ECP was submitted to Bob Murphy in August 2013. Mr. Murphy provided comments on the ECP in September 2013.

SWCA Environmental Consultants (SWCA) and Doug Krause (formerly of AEM) met with Bob Murphy, Deb Hill, and Ty Allen (by phone) on November 10, 2014. Additional concerns regarding prairie dogs and lesser prairie-chickens were raised. The USFWS recommended lesser prairie-chicken surveys be conducted in April 2015. It was suggested that Grant Beauprez (NMDGF) be contacted regarding lesser prairie-chickens. Mr. Beauprez provided updates on lek locations to SWCA's Pete David. Surveys were conducted as recommended, which are addressed in this document.

In April 2015, Pete David of SWCA discussed with Bob Murphy the company's intent to complete and resubmit a final BBCS and ECP and to conduct additional winter surveys following the wind energy guidelines protocol. Mr. Murphy was consulted regarding potential golden eagle use of the area. Mr. Murphy subsequently provided telemetry data from the fall of 2012 showing a juvenile golden eagle occupying an area primarily east and southeast of Tatum with occasional flights into the project area.

AEM and SWCA met with Bob Murphy and Jennifer Davis of the USFWS on April 11, 2016, to discuss the project, the results of the bird surveys, and post-construction monitoring.

4.1.2 SITE DESCRIPTION

This section meets the Tier 1 guidelines to provide an overall review of the area landscape and potential sensitivity or risk on a large scale.

The Sterling Wind Project site is located in Lea County in the southeast portion of New Mexico (see Figure 3.1). The project is situated on private property approximately 8 km (5 miles) north of Tatum, New Mexico. U.S. Highway 380 occurs 8 km (5 miles) south of the site, New Mexico Highway (NM) 125 forms the eastern boundary of the site, and NM 206 delineates the western boundary.

Ownership of land within the project area boundary is designated as unincorporated private, with a single landowner. The land has never been developed and is currently used exclusively as grazing land for beef cattle. An existing 69-kilovolt electric transmission line borders the eastern boundary of the site parallel to NM 125.

The project is located in the High Plains Arid Llano Estacado ecoregion. This region is a level, elevated plain with few streams, but many ephemeral pools. The region typically has little winter precipitation and, with a caliche layer close to the land surface, the area is subjected to persistent drought conditions (Griffith et al. 2006). Common soil series for this ecoregion include the Lea, Kimbrough, Sharvana, Duoro, Faskin, Stegall, Slaughter, and Conger series.

The region is characterized by grassland and shrubland. The natural shortgrass prairie vegetation for the region includes blue grama (*Bouteloua gracilis*), black grama (*B. eriopoda*), buffalograss (*B. dactyloides*), silver bluestem (*Bothriochloa saccharoides*), sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida* sp.), Arizona cottontop (*Digitaria californica*), hairy tridens (*Erioneuron pilosum*), muhly (*Muhlenbergia* sp.), bottlebrush squirreltail (*Elymus elymoides*), and sand sagebrush (*Artemisia filifolia*). Common shrubs include mesquite, narrowleaf yucca (*Yucca angustissima*), juniper (*Juniperus* sp.), and ephedra (*Ephedra* sp.). The major land use for the ecoregion is ranching and livestock grazing, oil and gas production, and a small amount of irrigated cotton, grain sorghum, and wheat (Griffith et al. 2006). The area would naturally support the Plains-Mesa Grassland community of east-central New Mexico as described by Dick-Peddie (1993).

Riparian and Wetlands

The project site sits on top of the High Plains, or Ogallala, aquifer where depth to water is 0 to 30.5 m (0–100 feet) below the surface (Robson and Banta 1995). Based on the critical issues analysis and the U.S. Geological Survey (USGS) National Hydrology Dataset, it was determined that the original project area contains one salt pond (Ranger Lake), two isolated intermittent drainages, and multiple human-made cattle ponds supplied by windmill-driven pumps. The current project area occurs adjacent to Ranger Lake and contains several cattle ponds (Figure 4.2).

Wildlife Corridors and Congregation Areas

The topography in the region is predominately characterized by flat grasslands. There are no obvious features that would tend to create natural points of wildlife congregation or corridors such as prominent ridgelines or mountain gaps that could potentially serve as a large-scale or regional migratory pathway for birds. No distinctive riparian areas are present to provide corridors for wildlife. Seasonally flooded, Ranger Lake contains highly saline water and typically does not attract large concentrations of waterfowl or waterbirds.

The grasslands in the project area are common and plentiful in the region. Some species of birds could concentrate in these grasslands during migration. The region does not contain an Important Bird Area designation, a Ramsar Convention site, or a Western Hemisphere Shorebird Reserve Network site. No specially designated state or federal management areas are located in the area.

Birds

Breeding bird surveys conducted on the Caprock route (approximately 48 km [30 miles] to the west) between 1977 and 2014 recorded 50 species (Sauer et al. 2016). However, this site represents a much more diverse topography, and the number of nesting species would not be considered necessarily representative of the project site, a habitat consisting of a flat, grassland plain. It would be expected that the latter site would have fewer breeding species, but be comparable in numbers of migratory species.

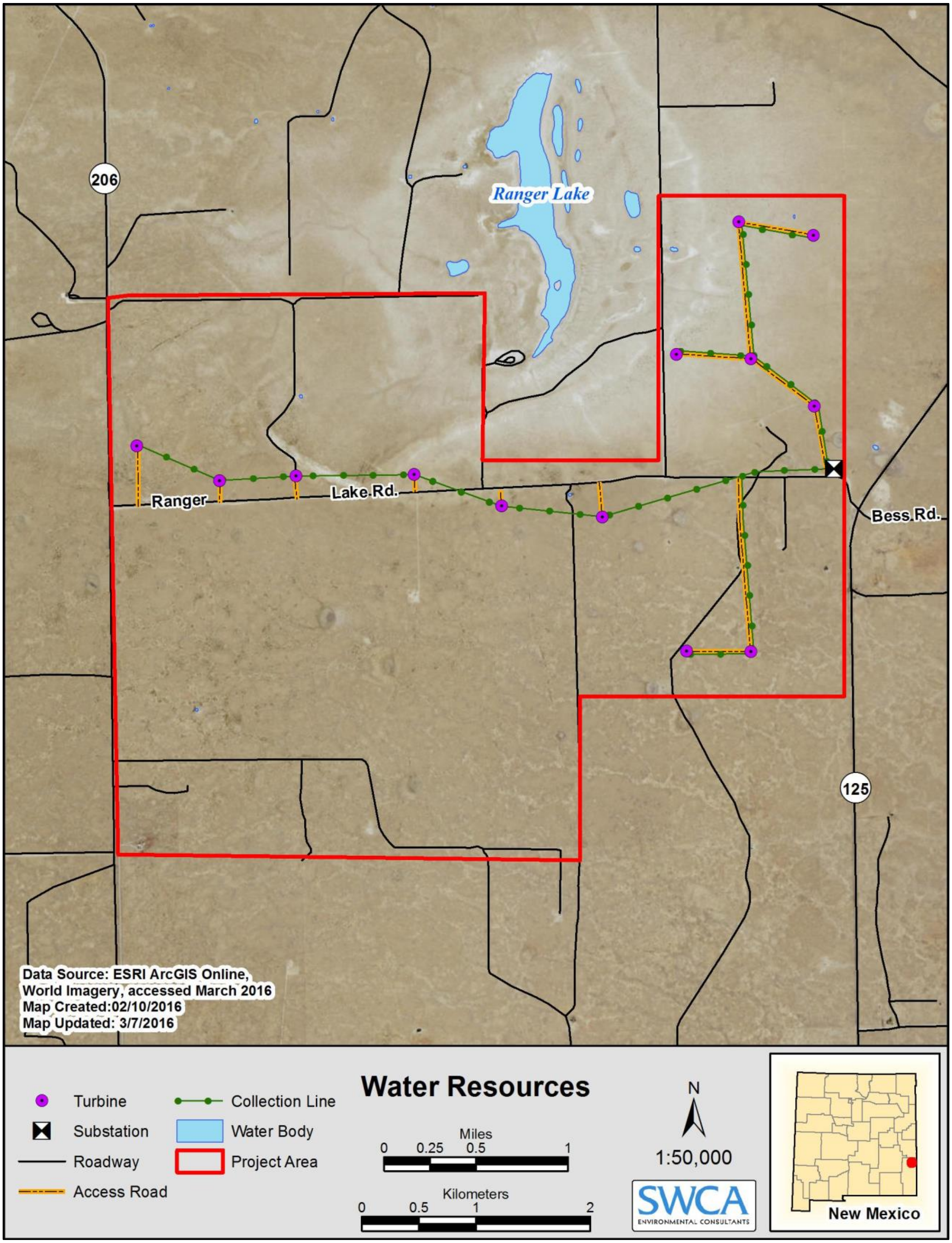

Figure 4.2. Water resources map.

Raptors

The presence of raptor species would be expected year-round. For species such as Swainson's hawk (*Buteo swainsoni*), the area contains breeding habitat, but suitable nesting substrate is limited to isolated single or groups of trees. Swainson's hawk and American kestrel (*Falco sparverius*) were the only two raptors recorded consistently on the Caprock route (about 48 km [30 miles] west of the project area) breeding bird surveys where data are available for most years from 1977 until 2014 (USGS 2016). No eagles were observed during these breeding bird surveys.

A review of Christmas Bird Count data (National Audubon Society 2016) and the Biota Information System of New Mexico (BISON-M) database (NMDGF 2016) indicates that 11 raptor species potentially winter in Lea County. Although golden eagles migrate through the area, the southeastern portion of New Mexico is also considered wintering territory for these birds (Cartron 2010). Data provided by Bob Murphy of the USFWS confirmed that a tagged juvenile male golden eagle used the project area for over a month in October and November 2011 before it was killed at a transmission line west of Tatum (personal communication, Robert Murphy, Division of Migratory Birds, USFWS, April 2015).

In general, the area appears to support a high diversity of raptors, but with low overall numbers of individuals.

Bats

There is little bat roosting habitat in the region. The absence of large trees in the grasslands would discourage tree-roosting bats. Caves, crevices, and other potential roost sites are generally absent in the area. There are numerous farm buildings that could provide habitat for some roosting bats.

Little is known about the distribution of bats in New Mexico. A number of species occurs at higher elevations or roost in trees and are unlikely to be present in breeding populations in the project area. Many bats migrate and appear to be more vulnerable to collisions with wind turbines during the fall period (Arnett et al. 2008).

Thirty species of bats are known to roost, hibernate, or otherwise reside in New Mexico. Many of these species are not expected to occur in the eastern plains. Ecology and Environment, Inc. (2012a) identified 18 species with the potential to occur in the project area (Table 4.1). Only one species of bat, the cave myotis (*Myotis velifer*), is listed by BISON-M (NMDGF 2016) to occur in Lea County. However, this is likely due to lack of survey effort, as many of the species listed in Table 4.1 are known to occur in adjacent counties.

Table 4.1. Bat Species with Potential to Occur in or near the Project Area

Species	Common Name	Roost Sites	Potential for Occurrence
Antrozous pallidus	Pallid bat	Caves, mines, rock outcrops tree cavities, buildings	Unknown
Corynorhinus townsendii pallescens	Townsend's big-eared bat	Caves, mines, buildings	Unknown
Euderma maculatum[1]	Spotted bat	Cliff faces, rock crevices, cracks	Possible transient
Eptesicus fuscus pallidus	Big brown bat	Buildings, bridges, trees, structures, caves, mines	Probable seasonal forager
Lasionycteris noctivagans	Silver-haired bat	Under bark, woodpecker holes, open buildings	Possible resident
Lasiurus borealis	Eastern red bat	Among foliage of trees	Possible transient
Lasiurus cinereus	Hoary bat	Among foliage of trees	Possible transient
Myctinomops macrotis	Big free-tailed bat	Rock crevices, buildings	Possible transient
Myotis californicus	California myotis	Mines, crevices, clay banks, bark, buildings, talus slopes	Possible resident
Myotis evotis	Long-eared myotis	Rock crevices, trees, buildings	Possible transient
Myotis yumanensis	Yuma myotis	Caves, mines, buildings, bridges	Probable forager
Myotis velifer incautus	Cave myotis	Caves, mines, buildings	Unknown
Myotis volans interior	Long-legged myotis	Trees, rock crevices, mines, streamside banks, buildings	Unknown
Myotis thysanodes	Fringed myotis	Caves, mines, buildings	Possible transient
Myotis ciliolabrum melanorhinus	Western small-footed myotis	Caves, mines, buildings, bridges	Probable forager
Nyctinomops femorosacca	Pocketed free-tailed bat	Crevices in cliffs and tall rocky outcrops	Possible transient
Nyctinomops macrotis	Big free-tailed bat	Crevices in cliffs, buildings	Unknown
Pipistrellus hesperus	Western pipistrelle bat	Rock crevices and piles, burrows, mines, buildings	Unknown
Tadarida brasiliensis mexicana	Brazilian free-tailed bat	Caves, mines	Probable forager

Sources: Ecology and Environment, Inc. (2012a).

[1] New Mexico state listed species.

4.2 DECISIONS OF SITE SELECTION

4.2.1 SITE-SPECIFIC CHARACTERIZATION AND DECISIONS (WIND ENERGY GUIDELINES TIER 2)

After completing a landscape evaluation as part of Tier 1, AEM initiated Tier 2 studies focused on the collection of site-specific information to determine potential impacts from the development of the project to environmental resources, particularly avian and bat species.

Based on site visits conducted by Ecology and Environment, Inc. (2012b), the project area habitat was characterized as heavily grazed former shortgrass prairie (Table 4.2), with encroachment of mesquite more prevalent on the western half. Further analysis using geographic information system (GIS) data determined that more than 82% of the project area consisted of shortgrass prairie (Figure 4.3), including large portions that had been recently burned when the mapping was completed.

Table 4.2. Vegetation Communities at the Project Site

Vegetation Type	Hectares (acres)	Percentage
Western Great Plains Shortgrass Prairie	1,668 (4,119)	82.4%
Apacherian-Chihuahuan Mesquite Upland Scrub	292 (720)	14.4%
Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	21 (51)	1.0%
Colorado Plateau Mixed Low Sagebrush Shrubland	18 (45)	0.9%
Inter-Mountain Basins Semi-Desert Shrub Steppe	16 (40)	0.8%
Others	10 (26)	0.5%
Total	**2,025 (5,000)**	**100.0%**

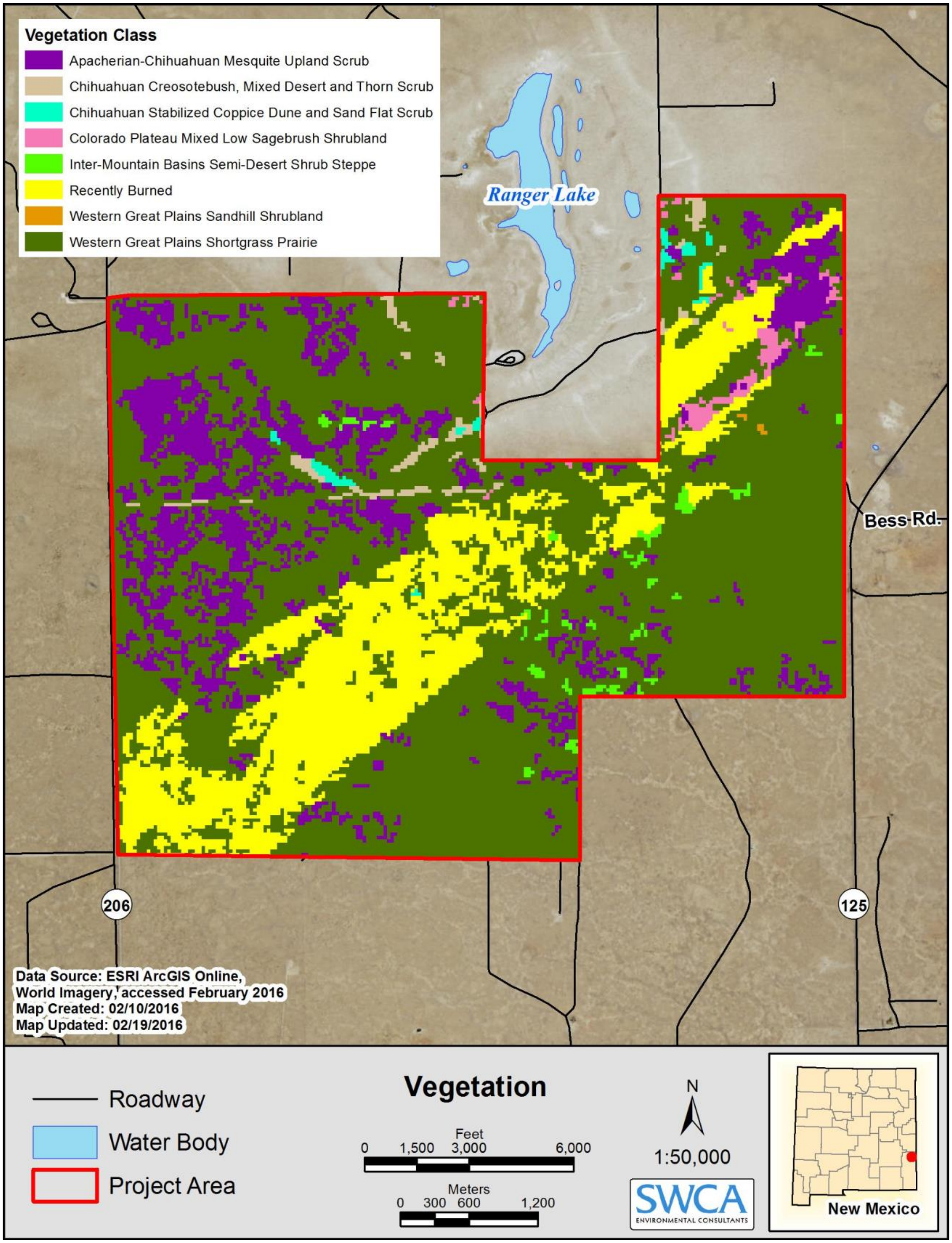

Figure 4.3. Vegetation types in the project area.

4.3 FIELD STUDIES TO EVALUATE PROJECT IMPACTS (WIND ENERGY GUIDELINES TIER 3)

4.3.1 BIRDS

Avian point counts were conducted in the project area by Ecosystem Management, Inc. from March 2009 to February 2010 (Ecosystem Management, Inc. 2010). The point counts were completed using the variable circular plot methods as described by Reynolds et al. (1980) with 12 observations stations and an 800-m (2,625-foot) radius circle centered on each point. The points were surveyed for 30 minutes every 2 weeks from mid-March to July 2009 (spring migration) and mid-September to mid-November 2009 (fall migration), and once a month in December 2009 and February 2010 for winter residents (see report in Appendix B). In total, 252 surveys were conducted (126 hours).

Winter raptor surveys were initiated on 5 days during the 2010–2011season at 20 points (Ecology and Environment, Inc. 2012b). The length of survey period on December 15, 2010, was 20 minutes, with the subsequent four surveys being reduced to 15 minutes. In total, 1,600 minutes (26.67 hours) were surveyed. Besides raptors, presence of other bird species was also recorded (see Appendix C).

The initial avian point counts identified a number of raptor species utilizing the project area. The USFWS and NMDGF expressed a desire to have further assessment completed of raptor activity. AEM completed an additional avian database review using publicly available avian database resources (Hawkwatch International and eBird.org) to compare raptor species diversity and density in the region with those documented at the project (Akuo Energy USA, Inc. 2011). The review also looked at the limited available research analyzing wind industry impacts to raptor species.

Due to the concern over possible presence of wintering golden eagles, SWCA conducted 26 days of additional surveys beginning in September 2015 and ending in March 2016. One survey (2 days) was completed in September, two surveys (4 days) were conducted in October, November and December. Due to snow, no surveys were conducted in January. Three surveys (6 days) were completed in both February and March. Specific survey objectives were to establish the relative distribution and abundance of fall migratory and wintering birds, focusing on raptors;

SWCA initiated 1-hour avian surveys using 800-m-radius (2,625-foot-radius, or 2-km²-radius [0.8-square-mile-radius]) circular plots at seven points (Figure 4.4). These plots were located to represent the major habitat types and to provide enhanced visibility. Each survey lasted 1 hour, with all birds observed being recorded in the first 10 minutes, but the remaining time was devoted to large birds as recommended in the wind energy guidelines (USFWS 2012a). Surveys were conducted between 8:30 a.m. and 3:00 p.m., and the order in which plots were surveyed was rotated to avoid a consistent pattern. Ninety-one survey hours were completed over 26 days.

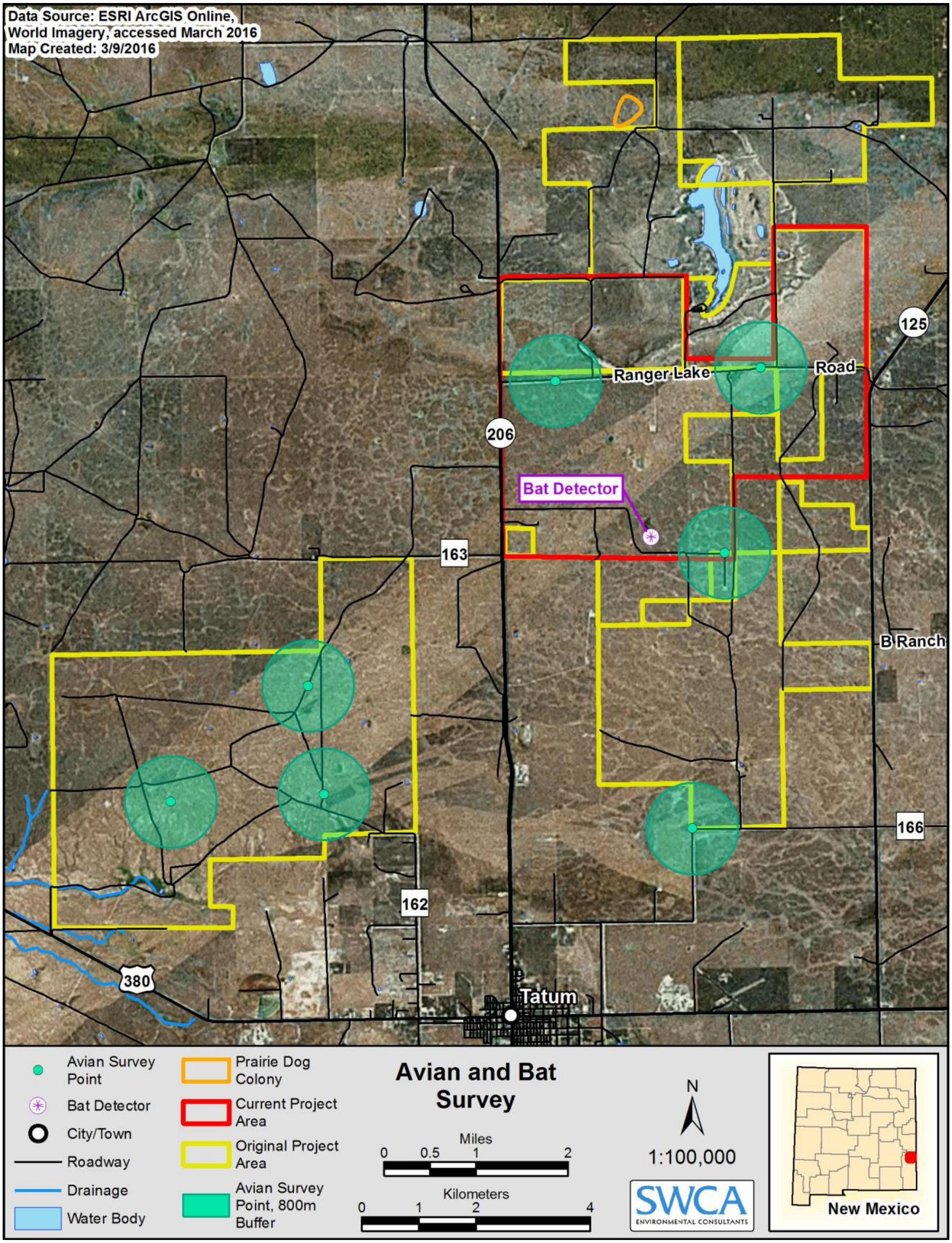

Figure 4.4. Location of avian and bat survey locations.

4.3.2 SENSITIVE SPECIES

Lesser prairie-chicken lek surveys were conducted by Ecosystem Management, Inc. in 2009 using roads running north-south through the project area (Ecosystem Management, Inc. 2010). Each survey route was surveyed 4 times between April 1 and May 10 with each survey conducted 7 to 10 days apart consistent with NMDGF lesser prairie-chicken roadside survey protocol.

With the previous discovery of lesser prairie-chicken leks in the vicinity of the project area and concerns raised by the USFWS, additional surveys were conducted in 2015. SWCA conducted lesser prairie-chicken surveys at 25 listening stations on March 19–20, March 31–April 1, and April 14–15, 2015 (Figure 4.5). The surveys were intended to cover the original project area.

4.3.3 BATS

Two acoustic detectors (AnaBat SD2, Titley Scientific, Australia) were deployed at two heights, one near ground level (5 m [16 feet]) and one within the projected rotor-swept area (RSA) at (50 m [164 feet]) on the existing meteorological tower located approximately 488 m (1,600 feet) from the proposed turbine array (see Figure 4.4) Pre-construction bat acoustic monitoring was conducted by Ecology and Environment, Inc. during the full bat migratory season from June 1 to December 16, 2011, in order to verify the characterization of low bat activity at the site during the peak periods (Ecology and Environment, Inc. 2012a).

The AnaBat units were set to continuously monitor the period from near sunset until near sunrise to ensure coverage of the primary period of activity for bats. The times were adjusted to accommodate seasonal changes in sunset and sunrise. For more information regarding the methods and equipment used for bat data collection, see the Ecology and Environment, Inc. (2012a) report (Appendix D).

Each detector was set to detect calibration tone with a sensitivity of 20 m (66 feet). The detectors were programmed to monitor from one-half hour before sunset until one-half hour after sunrise each night during the 28-week period. The bat echolocation data were digitally recorded and analyzed using AnaLook software (Titley Scientific, Ballina, New South Wales, Australia). All extraneous noise files (e.g., insects, rain, wind, lightning) were scanned and purged so that only bat echolocation call files remain. Each remaining file was considered a bat pass and used to calculate nightly activity levels for each detector throughout the sampling period. Bat passes of sufficient quality were identified to a species or species group by analyzing the echolocation call parameters and comparing them to a library of known bat calls.

A summary of field surveys and reports generated to support analysis of the project's potential environmental impacts is included in Table 4.3.

Table 4.3. Summary of Relevant Project Surveys and Reports

Survey/Report Type	Entity Responsible for Survey/Report	Dates
Critical Issues Analysis	Ecology and Environment, Inc.	January 2008
Avian Baseline Study	Ecosystem Management, Inc.	March 2009–February 2010
Raptor Nesting Survey	AEM	May 2011
Avian Database Review for Raptors	AEM and OS Sound Earth Consulting, LLC	July 2011
Bat Acoustic Monitoring	Ecology and Environment, Inc.	June –December 2011
Winter Raptor Surveys	Ecology and Environment, Inc.	December 2011–February 2012
Lesser Prairie Chicken Lek Surveys	SWCA	March – April 2015
Fall-Winter Raptor Surveys	SWCA	September 2015–March 2016

4.3.4 Bird Status Assessment

Bird Species Presence

The 2009–2010 baseline avian surveys resulted in 2,239 individual bird observations of 43 species (Ecosystem Management Inc., 2010). The three most abundant species observed in the study area were lark bunting (*Calamospiza melanocorys*), common raven (*Corvus corax*), and Swainson's hawk.

Ecology and Environment, Inc. conducted wintering raptor surveys on 5 days between December 2011 and February 2012 (Ecology and Environment, Inc. 2012b). The 15-minute surveys were conducted at 20 raptor point stations. The one survey in December was 20 minutes in duration, but Ecology and Environment, Inc. shortened surveys to 15 minutes for the remaining four survey periods. Seven different raptors species were recorded, with northern harrier (*Circus cyaneus*) and ferruginous hawk (*Buteo regalis*) being the most commonly observed species.

Results of the 2015–2016 point-count surveys are included in Table 4.4. In total, 520 birds of 20 species were observed during the surveys. Because the surveys were conducted in fall and winter, species diversity and the number of total birds recorded were lower than the 2009–2010 effort that extended into the spring. In addition, only the first 10 minutes of each 1-hour survey recorded all birds with the remaining time devoted to just raptors.

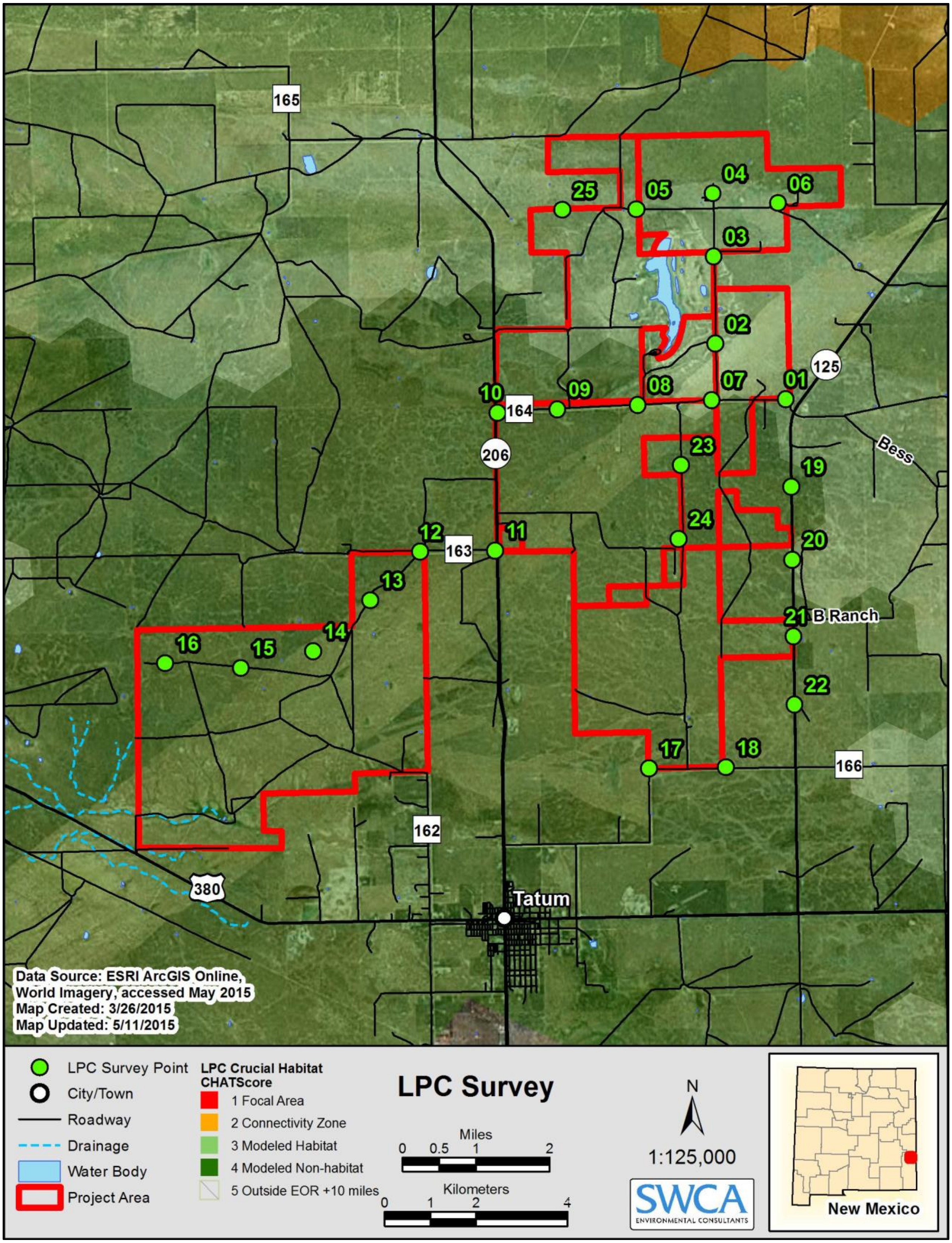

Figure 4.5. Lesser prairie-chicken survey locations and crucial habitat distribution.

Table 4.4. Total Observations, Percent Frequency of Occurrence and Mean Use for All Bird Taxa Observed at the Project Site during Fall–Winter Raptor Surveys

Species Common Name	Scientific Name	Total Count	Frequency of Occurrence (% of days observed)	Mean Use
American kestrel	*Falco sparverius*	7	23	0.06
Chihuahuan raven	*Corvus cryptoleucus*	115	81	1.10
Common raven	*Corvus corax*	6	11	0.06
Curve-billed thrasher	*Toxostoma curvirostre*	1	4	<0.01
Eastern meadowlark	*Sturnella magna*	5	11	0.05
Ferruginous hawk	*Buteo regalis*	15	42	0.14
Horned lark	*Eremophila alpestris*	127	89	1.21
Killdeer	*Charadrius vociferus*	1	4	<0.01
Lark bunting	*Calamospiza melanocorys*	4	7	0.04
Loggerhead shrike	*Lanius ludovicianus*	2	8	0.01
Long-billed curlew	*Numenius americanus*	1	4	<0.01
McCown's longspur	*Calcarius mccownii*	2	4	0.01
Meadowlark sp.	*Sturnella* sp.	8	12	0.08
Northern harrier	*Circus cyaneus*	25	58	0.24
Northern mockingbird	*Mimus polyglottus*	1	4	<0.01
Raven sp.	*Corvus* sp.	51	60	0.48
Red-tailed hawk	*Buteo jamaicensis*	2	8	0.01
Scaled quail	*Callipepla squamata*	119	62	1.13
Scissor-tailed flycatcher	*Tyrannus forficatus*	3	4	0.02
Sprague's pipit	*Anthus spragueii*	9	21	0.08
Swainson's hawk	*Buteo swainsoni*	8	4	0.07
Unidentified passerine	–	1	4	<0.01
Western meadowlark	*Sturnella neglecta*	38	46	0.36

Frequency of occurrence by species was calculated as the percentage of the surveys in which the species was observed out of the total sample days (24). Mean use is an average of the total number of individuals recorded for each bird species calculated by dividing the total count for each species by the 98 survey point counts. Horned lark (*Eremophila alpestris*), scaled quail (*Callipepla squamata*), and Chihuahuan raven (*Corvus cryptoleucus*) were the three most abundant birds and also the three species that occurred at the project area in the highest frequency.

No golden eagles were observed during the 2015-2016 survey period. Northern harrier was the most frequently observed raptor and was present throughout the survey period. Ferruginous hawk was also present beginning in October through March.

Sensitive Bird Species

Lesser Prairie-Chicken

The lesser prairie-chicken was listed as threatened by the USFWS in May 2014 (USFWS 2015). A federal judge decision in 2015 resulted in the bird being removed from the endangered species list, primarily due to the implementation of a range-wide plan being coordinated by the Western Association of Fish and Wildlife Agencies. Additional legal appeals by the USFWS are likely.

The Southern Great Plains Crucial Habitat Assessment Tool (SGP CHAT) (University of Kansas 2016) is a spatial model put together to designate and prioritize areas for lesser prairie-chicken relative to industry development. It represents a spatial representation of the *Lesser Prairie-Chicken Range Wide Plan*.

The SGP CHAT classifies crucial habitats and important wildlife corridors into four "actionable" categories, following guidelines of the Western Governors Association:

- **Category 1:** This category comprises the focal areas for lesser prairie-chicken conservation designated by teams in each state that prioritized and identified intact lesser prairie-chicken habitat. The goal in this category is to have 70% of the area within managed under lesser prairie-chicken conservation plans. The plans were defined using GIS layers such as landscape integrity models, aerial photographs, soil maps, anthropogenic disturbances, land cover data, and expert opinion.

- **Category 2:** This category comprises the connectivity zones for lesser prairie-chicken conservation. The connectivity zones were designated by teams in each state that prioritized and identified intact lesser prairie-chicken habitat. The goal in this category is to have 40% of the area within managed under lesser prairie-chicken conservation plans. The plans were defined using GIS layers such as landscape integrity models, aerial photographs, soil maps, anthropogenic disturbances, land cover data, and expert opinion.

- **Category 3:** This category is derived from the lek Maxent models. Maxent is short for maximum entropy classifier and is an ecological niche model used for describing available and potential habitat. The model uses base layers such as leks, nests, Conservation Reserve Program, land cover, abiotic site condition, etc., in a manner that allows for the results to characterize that habitat on the landscape.

- **Category 4:** This category comprises the estimated occupied range (EOR) for the lesser prairie-chicken plus 16 km (10 miles). The EOR is an expert-derived delineation that has 16 km (10 miles) added to it for range expansion and planning.

The project occurs in what is designated by SGP CHAT as either Category 3 (modeled habitat) or Category 4 (Modeled Non-habitat) (see Figure 4.5). However, the turbines located in the Category 3 habitat are separated from any lek habitat to the east by a power line that runs north-south. Therefore, turbine placement just east of Ranger Lake would not degrade potential lesser prairie-chicken habitat to the east since there is little previous potential for this area to be used as leks, due to the existing transmission infrastructure.

The 2009 surveys discovered two small leks, one outside the north boundary of the original project area and one just inside the northern boundary. The 2015 surveys failed to detect any active leks. Through further correspondence with the NMDGF, it was determined that the closest active lek as of 2014 was approximately 3.2 to 4.8 km (2–3 miles) northeast of Ranger Lake (personal communication, Grant Beauprez, NMDGF, April 7, 2015). Based on the 2015 data from the SGP CHAT, another active lek was about 3.2 to 4.8 km (2–3 miles) east of the project area.

Burrowing Owl

The western burrowing owl (*Athene cunicularia*) was listed as a federal species of concern, but delisted in 2003, although it continues to be a national priority species for the USFWS Office of Migratory Birds (Cartron 2010). The species has not been listed by the state as threatened or endangered but is protected by New Mexico statute 17-2-14 (New Mexico Statutes Annotated 1978).

Due to the presence of several prairie dog colonies, burrows used by these owls are readily available around the project area. While mapping the prairie dog colony, several burrowing owls were observed suggesting the owls are breeding in this location (see Figure 4.4 for the location of prairie dog colony). However, the nearest turbine in the current project layout is located nearly 3.2 km (2 miles) from the prairie dog colony where owls would be present.

Birds of Conservation Concern

The project occurs primarily in Bird Conservation Region 18 (Shortgrass Prairie). In addition to golden eagle, burrowing owl, and Sprague's pipit (*Anthus spragueii*), four other birds designated as species of conservation concern (USFWS 2008) have been recorded at the project site: prairie falcon (*Falco mexicanus*), long-billed curlew, McCown's longspur (*Calcarius mccownii*), and lark bunting. The latter species was reported in large numbers in 2009 and 2010 surveys (Ecosystem Management, Inc. 2010). Prairie falcon and McCown's longspur were rare or infrequently observed in the fall. Long-billed curlew were present in large numbers for a short period during fall migration.

During avian surveys conducted between September 2015 and March 2016, Sprague's pipits were observed throughout the project and surrounding areas. This species was recently delisted as a candidate for protection by the USFWS under the ESA. The first pipits were recorded during the October 29, 2015 survey. Additional observations of these birds were made through the December 15, 2015, survey. The area received considerable snowfall in January, which covered the grasslands and no surveys were conducted. Following the resumption of surveys on February 3, 2016, no pipits were observed for the remainder of the survey period. The large numbers of pipits observed is an indication the grasslands in the area may be used during the winter. The January snow may have encouraged the pipits to migrate further south.

Raptors and Migration Corridors

It is well known that raptors do not typically concentrate during spring migration as they do during fall migration (Bildstein 2006). During fall migration, topography and landscape features, in combination with behavioral, ecological, and meteorological factors, define raptor migratory routes (Kerlinger 1989). Important factors when assessing potential risk of a wind facility related to raptor migration include presence of landscape features that could concentrate raptors, high densities of small-mammal prey and conditions favorable to high prey densities, and raptor abundance (National Wind Coordinating Collaborative [NWCC] 2010; Smallwood and Thelander 2005).

Raptors tend to migrate along north-south-trending ridgelines, escarpments, upwind sides of slopes, canyons, and shorelines to take advantage of wind currents (NWCC 2010). Although no such topographical features are present in the project area, data from the 2009–2010 avian surveys recorded a two-fold increase in the frequency of raptors during the fall, primarily due to larger numbers of Swainson's and ferruginous hawks (Ecosystem Management, Inc. 2010). The latter, along with northern harrier and golden eagle, were observed more frequently in the winter. These three species were also the most abundant raptors present during the winter of 2010–2011

(Ecology and Environment, Inc. 2012b). Northern harrier and ferruginous hawk were the most abundant raptors during the 2015–2016 fall–winter surveys.

Waterfowl and Shorebirds

The project area has little suitable habitat for waterfowl and other water bird species. Ranger Lake is highly saline and gets limited water bird use. Areas of over flow next to stock ponds were used occasionally by small groups (1–3) of ducks.

No concentrations of shorebirds were observed at Ranger Lake. The lakeshore has potential to attract a few pairs of breeding birds such as American avocet (*Recurvirostra Americana*), a single bird was recorded during surveys in the spring of 2009. Long-billed curlews were observed in flocks of up to 40 birds in grassland habitat during fall migration.

4.3.5 BAT STATUS ASSESSMENT

Bat Species Presence

Ecology and Environment, Inc. completed a review of the bat data from the two detectors to provide a summary of species present and an assessment of overall levels of activity. The goals of the review were to evaluate overall levels of activity and determine the presence of sensitive and high-risk species (Ecology and Environment, Inc. 2012a).

The acoustic monitoring results from the project indicate low bat activity levels. No bat passes were detected on 71% of the successful detector nights, and the mean bat activity across both detectors was 0.33 passes per detector night. Based on the analysis of recorded data at the site, a higher number of bat passes was observed at the lower detector across almost all months (Table 4.5).

Table 4.5. Number of Bat Passes by Month

Month	Total Number of Bat Passes	
	Lower Detector	Upper Detector
June 2011	23	10
July 2011	2	0
August 2011	6	5
September 2011	18	22
October 2011	27	10
November 2011	2	0
December 2011	0	0
Total	**78**	**47**

The recordings were analyzed in more depth to classify the passes to either the species level or into one of four species groups based on minimum frequency and slope characteristics:

1. Pocketed free-tailed bat (*Nyctinomops femorosaccus*), hoary bat (*Lasiurus cinereus*), Mexican free-tailed bat (*Tadarida brasiliensis mexicana*), silver-haired bat (*Lasionycteris noctivagans*), pallid bat (*Antrozous pallidus pallidus*), and big brown bat (*Eptesicus fuscus*).
2. Townsend's big eared bat (*Corynorhinus townsendii pallescens*), fringed myotis (*Myotis thysanodes thysanodes*), and long-eared myotis (*Myotis evotis evotis*).

3. Cave myotis (*Myotis velifer*), long-legged myotis (*Myotis volans interior*), western small-footed bat (*Myotis ciliolabrum melanorhinus*), California myotis (*Myotis californicus*), and Yuma myotis (*Myotis yumanensis yumanensis*).
4. Eastern red bat (*Lasiurus borealis*) and western pipistrelle (*Pipistrellus hesperus*).

All but three bat passes were identified as belonging to Species Group 1. At the low detector, one bat pass was identified as Species Group 2 and one identified as Species Group 4. At the high detector, one low frequency call was attributed to the western mastiff bat (*Eumops perotis*), which was not thought to occur in the area since its mapped geographic range is limited to the southwestern portion of the state. The hoary bat of Species Group 1 is one of the most common species found during fatality studies at wind energy facilities (Arnett et al. 2008) and is therefore considered to be at high risk. No protected species were recorded.

Because of differences in equipment, sampling and analysis protocol, location, environmental setting, year of sampling, etc., it can be difficult making meaningful comparisons between sites. However, broad comparisons can be made of general trends if certain variables are eliminated. Accordingly, the 2011 project data were compared to data collected on three other regional sites (all within approximately 250 km [150 miles] during nearly the same time period [SWCA 2014]). Bat calls were detected and recorded from these sites using the same type of system that was used at the project site. Likewise, the data were processed and analyzed using the same protocols as those used for the current data set. In comparison, the project had very low bat activity compared to the other three sites. The lowest activity on the three sites was 2,704 bat calls over a 223-day period. The high activity site had 46,098 calls and a third site located on the Caprock, just 64 km (40 miles) southwest of the project site, had 13,435 calls over the same time period. In contrast, the project site received only 135 calls for an overlapping 166-day period.

Temporal Patterns of Bat Activity

Peak bat activity (highest number of bat passes and mean bat activity per detector night) was observed from June 7 to June 19 and September 4 to October 16. Hourly activity peaked between 10:00 p.m. and 3:00 a.m. at the lower detector (82.1% of all recorded bat passes) and between 10:00 p.m. and 12:00 a.m. at the high detector (68.1%).

Seasonal use patterns were typical for the project area's latitude. Activity levels increased during the spring, a time frame associated with bats leaving hibernation and traveling to maternity or summer foraging sites. Activity levels were highest in the summer and early fall before declining in late fall. Additional information is available from the Ecology and Environment, Inc. (2012a) report (see Appendix D).

4.3.6 BIRD RISK ASSESSMENT

Using the data gathered in various site assessments and field studies, as summarized in the sections above, SWCA has analyzed the potential direct and indirect impacts of the project to avian (non-eagle) and bat species. This analysis is presented in the following section and specifically addresses the likely direct impacts of the project in the context of collision and electrocution. Disturbance/Displacement and habitat fragmentation are also discussed under indirect impacts. Potential risks to bald and golden eagles will be presented in a separate ECP.

Collision risk to Migratory Birds

The 2010 avian report (Ecosystem Management, Inc. 2010) evaluated flight height characteristics of birds observed using the project area. This baseline study looked at flight height and 25 species were recorded flying in the "zone of risk", ranging between 25 to 125 m (82–410 feet) above ground. A number of species were only represented by a single observation in the zone, but corvids (ravens and crows) and raptors were observed frequently in this altitude range. An exposure index was calculated for each species observed in the zone. Common raven, long-billed curlew, and turkey vulture (*Cathartes aura*) had the highest exposure indices (see report in Appendix D).

Electrocution

Overhead transmission lines should be installed to Avian Power Line Interaction Committee (APLIC) (1996) standards, which will minimize the potential for electrocution and standards to reduce collisions (APLIC 2012). However, no overhead lines are currently planned for construction in conjunction with the development of the project.

Disturbance/Displacement

Wind energy facility infrastructure alters the landscape characteristics through placement of tall structures (towers and transmission lines) and road networks. Possible threats from these features include behavioral avoidance and auditory and visual disturbance (USFWS 2012a). The displacement of grassland bird species in response to wind energy development may be species-specific and the displacement response of individual species may be inconsistently observed (American Wind Wildlife Institute 2015).

The effects may also be temporary and confined to the construction area as breeding birds become acclimated to the operation noise. Modern turbines have noise levels near or below the 49-A-weighted-decibel (dBA) threshold known to impact breeding birds (Inglefinger 2001). American Wind Energy Association (2009) documentation indicates that current turbine noise levels are between 35 and 45 dBA at 350 m (1,150 feet) (i.e., noise level similar to background noise in most homes).

Persistent road use by heavy machinery during construction could cause disturbance of some nesting birds, though different species are likely to have varying tolerances to these types of activities. However, the areas where equipment will be used to install turbines will already have been cleared and birds are not likely to be nesting nearby.

The risk of displacement and disturbance can be reduced through measures taken during the design and construction phases of the project. These measures are described in detail below in Section 5 and include burying as much of the collection system as possible, minimizing surface disturbance to the extent possible, completing all of the vegetation clearing required by the project prior to the breeding season.

Based on the most current project design, an estimated 14.5 ha (36.3 acres) will be disturbed from project construction (Table 4.6). This represents less than 0.01% of the total 2,025-ha (5,000-acre) project area. Most of this disturbance will be temporary from the burying of collection lines. Only 5.5 ha (14 acres) of permanent habitat loss is expected from roads, turbine pads, and a substation.

Table 4.6. Acreage in Hectares (acres) Eliminated Due to Project Construction by Vegetation Type

Vegetation Type	Temporary	Permanent	Total
Western Great Plains Shortgrass Prairie	8.0 (19.8)	5.1 (12.7)	13.1 (32.5)
Apacherian-Chihuahuan Mesquite Upland Scrub	0.8 (2.0)	0.3 (0.9)	1.1 (2.9)
Other	0.2 (0.5)	0.1 (0.4)	0.3 (0.9)
Total	**9.0 (22.3)**	**5.5 (14.0)**	**14.5 (36.3)**

Habitat Fragmentation

The construction of the project may increase the degree of habitat fragmentation in the area due to the expansion of cleared land and the addition of improved roads already present. Additional measures taken during the design and construction phases of the project can reduce the degree of fragmentation. These measures are described in detail below in Section 5 and include burying the collection lines, following APLIC guidelines, and minimizing surface disturbance to the extent possible.

4.3.7 Bat Risk Assessment

A synthesis paper of nationwide bat mortality studies conducted at operational wind facilities was published by Arnett et al. (2009). This study presents three unifying patterns associated with bat fatalities at wind farms that are relevant to the assessment of risk in this project-scale context. First, fatalities were heavily skewed toward migratory bats and were dominated by migratory tree-roosting bats of the genus *Lasiurus* (e.g., hoary and red bats) and genus *Lasionycteris* (silver-haired bat). The species composition of fatalities at the studied wind facilities had a range of 9% to 88.1% for hoary bat (Arnett et al. 2009). Most (96%) of the bat passes recorded at the project site were identified as Species Group 1, which would include the hoary bat (see Ecology and Environment, Inc. report in Appendix D). One call was confirmed to be that of western mastiff bat, a species whose range is generally limited to southwestern New Mexico (Ecology and Environment, Inc. 2012a).

The estimated mean of 0.03 passes per detector-night at the project site is extremely low and well below other regional projects for which data are publicly available in the United States. The number of passes per detector-night is much lower than the 2.53 passes per detector night at a site located in eastern New Mexico (David 2014a). The bat activity for the project site is also considerably lower than a nearby site in southeastern New Mexico (David 2014b).

Bat activity rates have not been demonstrated to be a strong predictor of the magnitude of bat fatalities during operation of wind energy facilities (Hein et al. 2013). Although accurate pre-construction estimates of the magnitude of bat fatalities have proven to be elusive, the timing of turbine-related bat fatalities appears to be closely correlated with the timing of bat activity measured during pre-construction studies. This pattern appears to be relatively consistent throughout North America and may be related to mating and migration behaviors (Cryan and Barclay 2009). Acoustic surveys at Sterling indicate that bat activity is highest at the site in June and then again in September and October, the period when bat fatalities are also highest at most wind energy facilities studied to date (Baerwald and Barclay 2011).

Because of inherent limitations of the acoustic survey protocol it is unknown whether the recorded acoustic data accurately reflect actual bat activity in the project area. The data do, however, suggest patterns of bat use at the sample locations as baseline information for tracking changes over time in the surveyed locations. A thorough review of the survey results shows that the survey intensity and duration were adequate to accurately characterize bat use of the project area to the best ability of the protocol since the resulting seasonal activity pattern is typical for most surveyed areas in North America, with peak activity occurring from midsummer to early fall, suggesting that the relative seasonal patterns recorded are accurate. Further analysis of specific fatality risks to bats is not possible since species present at the site could not be positively identified.

Direct Impacts

Direct impacts on bats from construction and maintenance of wind facilities are discussed in detail in this section. These impacts fall into three categories: mortality from turbines, mortality from other hazards, and habitat removal and disturbance.

Mortality from Turbines

Bat mortality at wind farms occurs as a result of direct collisions with the turbine blades, barotrauma, or a combination of both; it is difficult to attribute individual fatalities exclusively to one or the other (Grodsky et al. 2011).

From a regional perspective, bat mortality at operational wind facilities is relatively low to moderate in open habitats (Arnett et al. 2008). Fatality estimates in the Midwestern, South-Central, Pacific Northwest, and the Rocky Mountain regions were comparable. Nationwide, the highest levels of mortality to date have occurred along forested ridgelines in the eastern United States, with estimates ranging from 9.4 to 40.6 bats per 2,000 m^2 (21,528 feet) of RSAs.

High-Risk Species

Research indicates that risk of wind turbine fatalities to bats is not equal among species (Arnett et al. 2008). In general, smaller-bodied species, such as *Myotis* bats, have not been found in large proportions during fatality studies, though they have been noted as the most common fatality at a study in the upper Midwest (Gruver et al. 2009). Approximately 75% of known bat fatalities are from three migratory species: hoary, silver-haired, and eastern red bats (Arnett et al. 2009). Both hoary bat and silver-haired bats are likely to be present at the project site. Brazilian free-tailed bats have been documented as fatalities at some wind facilities located within this species' range, occasionally forming a significant proportion of fatalities. However, of the many projects located within this species' range relatively few have investigated bat fatality rates or released the results of any surveys. The Ecology and Environment, Inc. 2012 report did not identify bats to species; therefore, without more detailed species specific information regarding which bats were detected at the project site, analysis of risk to individual species is not possible.

Presence in the RSA

Bat species with high levels of activity in the RSA during the pre-construction phase of the project are assumed to be at a higher risk of mortality than those species that were typically recorded below the RSA. This statement assumes that bats are being killed randomly by collisions or barotrauma and are not attracted to the turbines (Cryan and Barclay 2009). In light of the lack of published data on this topic, this metric remains important to consider.

The majority of bats at both the low and high detector were low-frequency species. Bats in the low-frequency groups sometimes display behavior (high-altitude flight patterns) that places them at risk of mortality from turbines. However, the field study documented fewer bat passes at the high detector, indicating that most (65%) bat calls were recorded below the RSA.

Species of Concern

None of the bat species likely to occur at the project site are listed as threatened or endangered. Only the spotted bat is listed as threatened in New Mexico, but it is not expected to occur in Lea County. A single call of a western mastiff bat was confirmed at the project site. This bat is listed as a species of greatest conservation need in Texas.

Other Mortality Hazards

The presence of wind facilities also increases potential for mortality of bats by the construction of new road networks (Lesiński 2008). The degree of impact depends on the intensity of road use, time roads are used, vehicle speeds, structure of the landscape, and foraging strategy of each species. Mortality from vehicle collisions is often hard to document and quantify, since the ultimate outcome of the bat may be unknown, and drivers may not even know that a bat has been struck. Roads may affect all bat species that fly at low altitudes, if driving occurs at dusk when bats are actively seeking water sources.

To date, White-nose Syndrome has not been detected in New Mexico. In the eastern part of the country, it has killed millions of bats (USFWS 2012b). At his time, this disease is not considered a significant mortality factor for more common species likely to be present in the project area.

Indirect Impacts

The proximity of water is important to most species of bats, primarily for drinking, but also because moist habitats typically support higher insect concentrations (Fukui et al. 2006; Jackrel and Matlack 2010). Water troughs and a few small stock ponds containing water are widely scattered in the project area.

Although indirect impacts to bats are possible, the low use of the area, lack of nearby habitat for hibernacula, and the minimal amount of potential roost habitat to be removed suggest any impacts to be minor.

5 AEM-COMMITTED CONSERVATION MEASURES

This section identifies avoidance and minimization measures that have been incorporated into the planning and design of the project to reduce impacts to birds and bats and their habitat during the construction, operation, and decommissioning of the project. These measures are based on the best management practices provided in the USFWS guidelines (USFWS 2012a) and use current project data to address site-specific concerns. This section also includes detailed advanced conservation measures to specifically address potential impacts to avian and bat species.

5.1 MEASURES TO AVOID/MINIMIZE DIRECT IMPACTS

5.1.1 FATALITIES

- The project turbines will feature tubular towers to reduce the ability of birds to perch, thereby reducing the risk of collision.
- The minimum number of aviation warning lights will be installed to meet Federal Aviation Administration recommendations to minimize possible attraction of birds and bats. The wind energy guidelines (USFWS 2012a) recommend the use of red, dual red and white strobe, or flashing lights, rather than steady-burning lights. Only a portion of the turbines should be lighted, and all pilot warning lights should be synchronized.
- The electrical collection lines between turbines (i.e., circuits) will be buried underground.
- Vehicle collision risk with wildlife will be minimized by instructing project personnel to drive at 48 km (30 miles) per hour or less, be alert for wildlife, and use additional caution in low-visibility conditions.
- Garbage and waste disposal by the project site will be managed to avoid creating attractants for wildlife.
- Stored parts and equipment, which may be used by small mammals for cover, will be kept away from wind turbines except when active maintenance or repairs are required.

5.1.2 DISTURBANCE/DISPLACEMENT/BEHAVIORAL CHANGES

The MBTA (16 USC 703) prohibits the take of migratory birds, their parts, nests, eggs, and nestlings. Executive Order 13186, issued on January 11, 2001, affirmed the responsibilities of federal agencies to comply with the MBTA. To ensure ground-disturbing activities do not result in the "take" of an active nest or migratory bird protected under the MBTA, the following conservation measures will be implemented:

- Ground-disturbing activities such as vegetation removal will be initiated before migratory birds begin nesting (March or April). If road and infrastructure construction is required during the bird breeding season (April 1–July 15), appropriate steps will be taken to prevent migratory birds from establishing nests in the potential impact area. These steps could include covering equipment and structures and use of various excluders (e.g., noise). Prior to nesting, birds can be harassed to prevent them from nesting on the site. Nests (excluding eagles and listed species) may be removed while being constructed before eggs or young are present. Shooting, killing and capturing birds, moving and possession of nests, and other similar activities will not be included in these methods.

5.1.3 Habitat Loss/Degradation/Fragmentation

Direct impacts from habitat loss and degradation are expected to be minimal. Permanent or long-term disturbance of habitat from construction will be only about 14.5 ha (36.3 acres), less than 0.5% of the total project area. Thus, landscape permeability is not expected to be significantly reduced. The following measures will be implemented into the project design to reduce direct impacts to habitat:

- The electrical collection system is buried underground and mostly collocated with other project features. Areas of disturbance will be reseeded with native species to reduce long-term habitat impacts.

5.1.4 Measures to Avoid/Minimize Indirect Impacts

The following avoidance measures will be incorporated into the project design:

- Auxiliary buildings will use lights that are motion sensitive rather than steady burning, with light cast downward.
- Disturbance will be minimized by using existing roads, power lines, fences, and other infrastructure to the greatest extent practicable.
- Construction vehicle movement within the project area will be restricted to pre-designated access, contractor-required access, and public roads.
- Fire hazards from vehicles and human activities will be minimized (e.g., spark arrestors are used on power equipment, off-road driving is avoided).

5.1.5 Measures to Offset and/or Compensate for Habitat-related Impacts

- Surface restoration to pre-existing conditions will be completed for temporary disturbance areas and construction roads not needed for operations, including recontouring and reseeding with an appropriate seed mix for the environmental conditions of the site and according to any specific landowner requests. To the extent possible, a native seed mix will be used to establish an herbaceous groundcover to allow passive restoration of mixed shrub/herbaceous habitat.
- When the project is ready for decommissioning, the land used for operation of the facility will be restored to the original land use prior to construction within 6 months.
- Restoration will include the removal of all facilities related to operating the project (including above or below ground to a depth of 1 m [3 feet]). Disturbed lands will be reseeded with herbaceous flora appropriate for the land use (e.g., native, agricultural, Conservation Reserve Program seed mixture), consistent with landowner obligations.

5.1.6 BEST MANAGEMENT PRACTICES TO MINIMIZE OTHER PROJECT-SPECIFIC RISKS

The following best management practices have been and will continue to be implemented during operation of the project to minimize impacts to avian and bat species:

- **Vegetation Management**. Natural materials (i.e., rock piles, woody debris piles) and tall vegetation (i.e., tall forbs, grass, weeds) will be removed/maintained beneath turbines to reduce shelter and forage for small mammals, thereby reducing prey availability for raptors and minimizing raptor foraging in proximity to turbines.
- **Wildlife Carcass Management Program**. Wildlife carcasses attract vultures, eagles, and other scavengers; therefore, the likelihood of collision increases when carcasses are present at a project site. AEM will work with landowners and local and state agencies to ensure the regular removal of any dead medium-sized and large mammals (cattle and pronghorn [*Antilocapra americana*]) from the area of the project. Through consultation with the NMDGF, alternate disposal areas for these carcasses should be located that are safer and that could benefit the local eagle population. This measure is aimed at preventing eagle attraction to the site, reducing the potential for collision and impact to the regional eagle population. To reduce the likelihood of attracting eagles within the project's footprint, project personnel will:
  - look for animal carcasses while traveling through the site. All carcasses identified will be reported to the site manager within 8 hours and removed from the site within 48 hours of notification.
  - look for kettles of vultures, eagles, or other scavenger birds that are circling in one area. Any kettles observed will be reported to the site manager within 8 hours, and the area below the kettle will be searched for carcasses within 24 hours. Any carcass found will be removed from the site within 48 hours of identification.

5.1.7 WORKER EDUCATION AWARENESS PROGRAM

See Section 9.

6 TIER-4 POST-CONSTRUCTION MONITORING TO ESTIMATE IMPACTS

To comply with Stages 4 and 5 of the USWFS wind energy guidelines, 2 years of post-construction monitoring will be completed to assess fatalities and habitat-related impacts. AEM will communicate the results of these studies to the USFWS. A detailed post-construction monitoring plan is included below. It is recognized that the plan—the methods and timeline described herein—may be adapted as the project progresses to incorporate new survey techniques and protocols that may become available.

The primary objectives of Tier-4 post-construction monitoring and reporting are to document mean annual avian and bat fatality rates and record species composition of fatalities to enable comparison between pre-construction assessments and actual mortality. In addition, post-construction monitoring will be used to evaluate if any additional avoidance and minimization measures might be appropriate or whether a second year of monitoring is warranted.

The initial post-construction monitoring will be used to estimate the actual level of fatality and will be completed concurrently for birds and bats. Post-construction reports will discuss bird and bat fatalities in the context of predicted risk to assess the accuracy of pre-construction estimates of impacts and the effectiveness of any mitigation and adaptive management measures undertaken prior to construction.

6.1 CARCASS SEARCHES

Surveys for avian and bat fatalities will be initiated following commencement of project operations and continue for a full year to evaluate fatality levels from operation of the project. A second year is proposed for the September through March period to focus on sensitive species that only migrate or winter in the project area. Following the survey period, AEM will implement an internal monitoring program conducted by on-site workers to track fatalities for the rest of the life of the project (see Section 9.1).

Most birds and bats killed by wind turbines are found within 63 m (207 feet) of the turbine (reviewed by Young et al. 2003); therefore, plot dimensions must ensure that all areas within 63 m (207 feet) of the turbine are surveyed. Based on recent recommendations by the NWCC and American Wind Wildlife Institute, and due to the possible presence of large birds such as eagles, survey plots of 120 × 120 m (394 × 394 feet), centered on the wind turbine mast should be adequate to cover a sufficient area. All 13 turbines would be surveyed monthly using transects spaced at 10-m (33-foot) intervals.

Data collected for each carcass will include species, age, sex, estimated time since death, condition, type of injury, cover type, global positioning system (GPS) coordinates, distance to nearest wind turbine generator location, distance to nearest road, and distance to nearest structure. In the field, surveyors will record wind speed, direction, temperature, sky conditions, precipitation events, and visibility at time of survey. All observed carcasses will be photo-documented and identified to the lowest taxonomic level possible using photographs, field notes, and relevant scientific references.

6.2 SEARCHER EFFICIENCY TRIALS

Searcher efficiency studies will be conducted to quantify searcher bias. The results of these studies will be used to develop correction factors to estimate adjusted fatalities for the project and for each surveyed turbine, as appropriate. Additionally, survey intervals may need to be adjusted based on the findings of these studies to ensure the use of precise correction factors, using methods similar to those described by Huso (2011).

Searcher efficiency rates are expressed as the proportion of study carcasses that are detected by searchers in the searcher efficiency studies. These rates will be grouped by carcass size and season for the adjusted fatality estimate.

Separate searcher efficiency rates will be determined for the following three categories:

- Bats
- Large birds, defined here as
  - raptors (Falconiformes [diurnal birds of prey] and vultures);
  - waterfowl (Anseriformes, or ducks, geese, and swans); and
  - water birds (bitterns, herons, egrets, ibises, and cranes)
- Small birds (non-large bird species, primarily passerines)

The studies will be conducted for each two-person searcher team. Searcher efficiency studies will be completed spring and fall to account for different field conditions (e.g., dense spring vegetation, dry summer vegetation) that may affect the ability of the surveyors to locate carcasses.

Carcasses of species that approximate the size of each species in these categories will be used for searcher efficiency studies. Mouse carcasses will be used to represent bats if bats are not available, quail and similar sized bird carcasses will be used to represent small birds, and chickens and similar sized carcasses will be used to represent large birds (Erickson et al. 2000) These surrogates are proposed, as they are readily available and used in other similar studies; however, we will examine using other representative carcasses during the course of the study. Carcasses will be distributed throughout the survey plots in locations unknown to the searchers.

Prior to initiating the searcher efficiency study, carcass locations will be randomly generated but constrained, so that no more than three carcasses for a specific size group will be located at any one turbine at a time to avoid predator swamping. A senior biologist who is not participating in the searcher efficiency studies will plant carcasses at these predetermined turbines. Carcasses will be dropped from waist level so that they land in a random position and location. The position and location will be recorded for later comparison with actual fatalities. The biologist will record the location of each carcass with a GPS unit, as well as ground cover type, vegetation, turbine number, date, and time.

When surveyors locate a placed carcass, they will record the location using a handheld GPS unit, which will be compared in GIS to the locations recorded during placement. The percentage of planted mice, quail, and chickens located by surveyors will be used to generate a correction factor (by turbine as appropriate) to estimate the actual number of bats or birds killed, based on the number of observed fatalities

Searcher efficiency rates are expressed as the proportion of study carcasses that are detected by searchers in the searcher efficiency studies. These rates will be grouped by carcass size and season for the adjusted fatality estimate. The data will not be stratified by vegetation cover type, as the adjusted fatality estimate analysis only allows for one to two covariates (i.e., season and/or carcass size) and vegetation cover type is similar throughout the site (i.e., limited by sample size). In order to have an adequate sample size, 10 carcasses per stratum (i.e., bats, large birds, small birds) per season will be used.

6.3 Carcass Removal Studies

The objectives of the carcass removal studies are to document the length of time carcasses remain in the surveyed area and are available to be found by searchers, and to determine the appropriate frequency of carcass searches for turbine-associated fatalities within the search plots. Carcass removal studies will be completed for two seasons (spring and fall) and concurrently with the searcher efficiency studies described above. Different seasonal rates for carcass removal are necessary to address changes in scavenging throughout the season, as well as over time, because scavengers adapt to novel food sources.

Carcasses will be placed as described for searcher efficiency studies. They will be checked on days 1–4, 7, 14, and 28 following placement, or until they are all removed. Separate carcass removal rates will be determined for bats, small birds (passerines), and large birds (raptors). All animals used in the carcass removal studies will be handled with disposable nitrile gloves or an inverted plastic bag to avoid leaving a scent on the carcasses and interfering with the scavenger removal study (Arnett et al. 2009).

The mean carcass removal rate will be derived from the carcass removal studies and will be used to adjust the search interval. Estimates of the probability that a carcass was not removed in the time between surveys and therefore was available to be found by searchers will be used to adjust carcass counts for removal bias (Huso 2011; Huso et al. 2012).

6.4 Adjusted Fatality Estimates

Unadjusted (observed) fatalities (i.e., raw carcass counts) and adjusted fatality estimates (raw carcass count data adjusted for imperfect detectability) will be presented in a report. Adjusted fatality estimates are based on observed carcasses found during formal carcass searches, the probability that a searcher will miss a carcass (searcher efficiency correction factor), the probability that a carcass will be removed before a searcher can locate it (carcass persistence correction factor), and the proportion of turbines searched to the total number of turbines at the facility.

Avian and bat fatality estimates will be calculated using an industry-accepted statistical estimator; searcher efficiency and carcass persistence results may inform the specific estimator used. The statistical estimator used in Huso (2011) and Huso et al. (2012) is currently thought to be reliable for reducing biases in the data. The estimator also can account for unsearched areas within the search plot. Adjusted avian fatality estimates will be presented by summary groups (i.e., birds overall, small birds, and large birds) per year for the total project area, per turbine per year, and per MW per year.

7 TIER-5 ADAPTIVE MANAGEMENT

The mitigation measures and adaptive management techniques described in this section have been developed to ensure effective mitigation to offset any bird or bat mortality associated with operation of the project that could affect rare species' populations. Federally listed species (i.e., ESA listed or birds of conservation concern [USFWS 2008]) are considered the species most in peril; therefore, it is assumed that mortality of those species would have the greatest effect on populations and species' persistence. Similarly, state listed species have been identified as having the most conservation concern for that state and, like federally listed species, mortality is assumed to have greater implications on the persistence of those species' populations. Therefore, addressing federally and state listed species in this BBCS effectively ensures that population-level impacts to all avian and bat species would not occur. If at some time a new species becomes more imperiled and is added to the state, federal, or both lists, it will be addressed in a revised BBCS. Conversely, through communication with the USFWS, if a species is removed from listing because of its recovery, it would no longer need to be addressed as such in the BBCS.

7.1.1 Operational Mortality Thresholds

As defined in the USFWS (2012a) *Land-Based Wind Energy Guidelines*, adaptive management is "an iterative decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood." The most effective way to implement an adaptive management process is by using a tiered mitigation approach, combined with monitoring. The following steps were used to form the tiered approach proposed here:

1. **Develop mortality thresholds.** Using pre-construction site-specific data and regional data, mortality thresholds that represent the best understanding of how much mortality a species or group of species can withstand before having population-level effects were determined. Thresholds were developed for special-status species only, as these species are the most imperiled, and mortality is most likely to have population-level impacts on those species.
2. **Develop mitigation phases.** Should a threshold be exceeded, AEM would communicate with USFWS about potential mitigation. Mitigation would be developed in phases, the first phase uses the most simple mitigation method (i.e., the lowest-cost method) to address the specific cause of mortality. If it is unknown how to mitigate for a specific mortality, an offset may be used.
3. **Implement a monitoring program.** A monitoring program protocol was developed to assess impacts from operation (see Section 6 above). Each time a threshold is exceeded, a progressively higher mitigation phase is implemented. Additional

monitoring targeted to evaluate mitigation strategies would be considered if thresholds are exceeded.

7.1.2 Avian and Bat Fatality Thresholds

Fatality thresholds have been developed for avian and bat species known to occur or that may occur in the project area. For this BBCS, species for which thresholds have been designated are protected under the ESA, the BGEPA, and/or state regulations, which protect against unlawful take. Currently, there are two federally listed threatened or endangered bird or bat species likely to occur in the vicinity of the project area (see Appendix A).

Observation of other federally or state listed species not listed in Appendix A or changes in federal or state listing status for avian and bat species occurring within the project area may result in the addition, removal, or reclassification of species for mitigation thresholds. These thresholds do not permit take but have been developed to address the greater concern posed by potential population impacts to those species in order to ensure that impacts are not substantial.

It is recognized that the thresholds developed for the project are somewhat arbitrary, but in lieu of numbers and trend data for many avian and bat species/species groups, the thresholds provide a means for implementing a mitigation strategy that meets project operation and conservation objectives. Species-specific mortality thresholds will not have searcher efficiency or scavenger rate correction factors applied, because the factors correct for observations of all species but do not provide a way to correct for species-specific mortality.

7.1.3 Operational Mitigation

Thresholds have been developed for implementation of mitigation that would be determined through communication with wildlife biologists for the appropriate agency and other experts taking into consideration each species' regulatory and conservation status and general vulnerability to population decline (Table 7.1). A fatality of a high sensitivity (federally listed) species would trigger consultation with the USFWS. Should thresholds for moderate and low sensitivity species be exceeded, mitigation could include an additional year of post-construction monitoring, focused monitoring to identify a specific operational problem, or off-site mitigation to improve species habitat or populations.

Table 7.1. Annual Mitigation Fatality Thresholds for Avian and Bat Species

Sensitivity	Threshold Category	Threshold Value* Large Birds (non-eagles)	Threshold Value* Small Birds	Threshold Value* Bats
High	Threatened or endangered species under the ESA or either eagle species	1†	1†	1†
Moderate	USFWS candidate species or New Mexico listed or sensitive species	5	15	20
Low	*Birds only:* USFWS birds of conservation concern for Bird Conservation Region 6 species *and* not listed as candidate, or New Mexico sensitive species	10	30	NA
	Bats only: Not listed as candidate, or New Mexico sensitive species	NA	NA	40

* For a given species, the number of individuals killed or injured and non-releasable per approximately 30 MW of nameplate capacity per year, rounded to the nearest integer.

† Does not authorize take. Take of a listed species requires formal consultation with the USFWS under Section 10 of the ESA.

8 PROJECT PERMITS

A consultant will be acting as the agent and conducting the post-construction avian fatality and disturbance monitoring on behalf of the project. A directive from Washington, D.C., in March 2012 advised USFWS regional offices that applications for special purpose permits, including salvage permits for utilities, must originate from the owner or operator of the wind facility (personal communication, Katie Wade Matthews, USFWS, January 23, 2014). AEM chose not to request permits and all carcasses will be marked and left on site.

9 REPORTING FORMATS AND SCHEDULES

9.1 LONG-TERM PROJECT MONITORING

Following the completion of formal post-construction monitoring, AEM will implement an internal monitoring program, which will be used by on-site project personnel to record avian and bat fatalities over the long-term duration of operation. The intent of this monitoring program will be to ensure that the turbines at the site are frequently inspected for possible avian or bat impacts and that if impacts are identified, they are recorded, agencies are notified, and mitigation measures are identified and implemented. The monitoring program will be used for the life of the project beginning after the second year of post-construction monitoring studies. The study will accomplish the following:

- Provide a means of recording and collecting information on incidental avian and wildlife species found dead or injured within the project area by on-site project personnel.
- Produce a set of standardized instructions for on-site project personnel to follow in response to wildlife incidents in the project vicinity.
- Keep on-site project personnel mindful of wildlife interactions.

The following will occur during the second year of operations and will continue for the duration of operations:

- A worker education awareness program will be presented to contractors, project operations staff, and other personnel who will be on-site on a regular basis. The program will provide instruction on identification of local wildlife and avoidance of harassment and disturbance of wildlife (including birds and bats), especially during reproductive (i.e., courtship, nesting) seasons.

The following will occur if dead or injured birds or bats are found at the project by on-site project personnel:

- If a fatality of an eagle or a species listed under the ESA is recorded, the finding will be reported within 24 hours, if not sooner.
- A GPS location will be collected and photographs taken.
- The animal will not be moved or removed by any individual who does not have the appropriate permits.

- As needed, the project manager will coordinate with the USFWS to arrange transportation and treatment of an injured threatened or endangered species or eagle to a local, approved rehabilitation center.

10 CONTACTS/KEY RESOURCES

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The USFWS should be contacted within 24 hours should an eagle mortality be discovered. A complete coordination process for reporting fatalities will be developed as part of the on-site personnel training program.

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APPENDIX A
FEDERAL AND STATE OF NEW MEXICO LISTED BIRDS FOR LEA COUNTY

Common Name (Scientific Name)	Status*	Habitat	Range
Birds			
American peregrine falcon (*Falco peregrinus anatum*)	State: T	Nests in the canyons and river corridors.	Widespread range but little suitable habitat in southeastern New Mexico.
Northern aplomado falcon (*Falco femoralis septentrionalis*)	Federal ENEP State E	Associated with semi-desert grasslands with scattered yuccas (*Yucca* sp.), mesquite, and cacti.	Naturally occurring populations are essentially restricted to southern New Mexico.
Bell's vireo (*Vireo bellii*)	State T	Bell's vireo's fundamental requirement is dense shrubby vegetation. Proximity to water may also be important.	In New Mexico, Bell's vireo occurs in the southern third of the state during the breeding season. The *medius* race is found in the Pecos Valley north to drainages west of Roswell, and in the Black River and Rattlesnake Springs areas south of Carlsbad.
Bald eagle (*Haliaeetus leucocephalus alascanus*)	State T	In migration and during winter months, the species is found chiefly along or near rivers and streams and in grasslands associated with large prairie dog colonies.	Occurs in New Mexico year-round. Breeding is restricted to a few areas, mainly in the northern part of the state along or near lakes.
Baird's sparrow (*Ammodramus bairdii*)	State T	Generally prefers dense, extensive grasslands with few shrubs. Avoids heavily grazed areas.	Baird's sparrow is a winter resident in New Mexico. It has been found on Otero Mesa and in the Animas Valley and may occur in other areas of suitable winter habitat, particularly in the southeast portion of state.
Broad-billed hummingbird (*Cyanthus latirostris*)	State T	Uses mostly low- to moderate-elevation riparian woodland areas.	Local and uncommon species, which summers primarily in Guadalupe Canyon in southwestern New Mexico

Federal (USFWS) status definitions:
C = Candidate. Any species (taxon) for which the USFWS has sufficient information to propose that it be added to the list of endangered and threatened species, but the listing action has been precluded by other, higher priority listing activities.
ENEP = Experimental, Non-essential Population. Any reintroduced population established outside the species' current range, but within its historical distribution. For purposes of Section 7 consultation, experimental, non-essential populations are treated as proposed species (species proposed in the *Federal Register* for listing under Section 4 of the ESA), except on national wildlife refuges and national parks, where they are treated instead as threatened.
T = **Threatened.** Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The ESA specifically prohibits the take (see definition above) of a species listed as threatened.

State (New Mexico) status definition:
E = Endangered. Any species that is considered by the State of New Mexico (NMDGF for wildlife, Forestry and Resources Conservation Division for plants) as being in jeopardy of extinction or extirpation from the state.
Except where otherwise noted, range or habitat information for wildlife species is taken from the BISON-M website (NMDGF 2016).
T = **Threatened.** Any species that, in the view of the State of New Mexico, is likely to become endangered within the foreseeable future throughout all or a significant portion of its range in New Mexico. Except where otherwise noted, range or habitat information for wildlife species is taken from the BISON-M website (NMDGF 2016) and Cartron (2010).

APPENDIX B
BASELINE AVIAN SURVEYS FOR THE PROPOSED STERLING RANCH WIND FARM, LEA COUNTY, TATUM, NEW MEXICO

APPENDIX C
WINTER RAPTOR REPORT FOR THE PROPOSED STERLING WIND PROJECT, LEA COUNTY, NEW MEXICO

APPENDIX D
FINAL BAT ACOUSTICAL MONITORING REPORT FOR THE PROPOSED STERLING WIND PROJECT, LEA COUNTY, NEW MEXICO

APPENDIX B
EAGLE CONSERVATION PLAN

Eagle Conservation Plan for the Sterling Wind Project, Lea County, New Mexico

Prepared for

AEM Wind, LLC

Originally prepared May 2016 by

SWCA Environmental Consultants

Revised April 2019 by

Hawkpoint Environmental Consulting, LLC

EAGLE CONSERVATION PLAN FOR THE STERLING WIND PROJECT

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April 2019

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1 INTRODUCTION AND PURPOSE

This Eagle Conservation Plan (ECP) has been voluntarily prepared by AEM Wind, LLC (AEM) for the Sterling Wind Project (project) to supplement the project Bird and Bat Conservation Strategy (BBCS) previously submitted by SWCA Environmental Consultants (SWCA) to the Region 2 Office of the U.S. Fish and Wildlife Service (USFWS). This document was produced to specifically and proactively address potential impacts to golden eagle (*Aquila chrysaetos*) and bald eagle (*Haliaeetus leucocephalus*) resulting from the construction and operation of the project. This ECP includes information about the project, the purpose and goal of the plan, an assessment of regional and site-specific eagle habitat and use, an assessment of project-specific impacts to eagles, proponent-committed eagle conservation measures, eagle fatality estimation and risk categorization, and post-construction eagle monitoring, reporting, and adaptive management.

The goal of this ECP is to meet the intent of the Bald and Golden Eagle Protection Act of 1940 (BGEPA), as amended, by managing risk to eagles for no net loss to the species. It is AEM's goal to have an environmentally sustainable project, which means ensuring that project-specific impacts do not lead to a net loss of eagles. The primary threat to eagles from land-based wind energy facilities addressed under the initial (USFWS 2011) and *Final Eagle Conservation Plan Guidance* (*ECP Guidance*) (USFWS 2013) is from direct mortality as a result of the operation of wind energy facilities. Also addressed are activities that might disturb eagles at concentration sites or result in loss of nest productivity or long-term nesting territory associated with pre-construction, construction, or operation and maintenance of the project.

While it is not possible for the USFWS to absolve individuals, corporations, or agencies from liability, the USFWS Office of Law Enforcement focuses its resources on investigating and prosecuting individuals and companies that take eagles without regard for their actions or without taking effective steps to avoid or minimize potential risk and take. This ECP represents an agreed-upon understanding and commitment between AEM and the USFWS to minimize potential effects to eagles and support the issuance of an eagle take permit for the project.

1.1 AEM COMMITMENT TO ENVIRONMENTAL PROTECTION

AEM is firmly committed to developing wind energy projects in an environmentally responsible manner. Throughout the development of the project, AEM has sought to minimize its potential impacts on the environment to the greatest extent practicable and consult with necessary government staff at the state and federal levels (see below). AEM has applied appropriate recommended USFWS guidelines, including setbacks of wind turbine infrastructure away from potentially sensitive resources. AEM has also completed a full assortment of pre-construction eagle surveys, assessing potential eagle use and risk while adhering to recommended guidelines issued from the USFWS. A BBCS was also developed to avoid and minimize potential impacts to bats and migratory birds (SWCA 2016; Hawkpoint Environmental Consulting 2019). The BBCS provides an assessment of birds and bats and the potential for impacts to species and their habitat during the planning, construction, and operation of the project. Many of the recommendations for minimizing impacts from siting, configuration, construction, and operation in the BBCS are also applicable to eagles. AEM will continue to communicate with the USFWS to develop this project to reduce the potential for future mortality of eagles as evidenced by the completion of this ECP and the pursuit of an eagle take permit.

This project ECP has been developed in accordance with the USFWS's *Final Land-Based Wind Energy Guidelines* (*Final Guidelines*) (USFWS 2012) and the *ECP Guidance* (USFWS 2013) and was intended to support the project's application for an eagle "take" permit. With the pursuit of an incidental take permit, the federal action of issuing a "take" permit for eagles required that an Environmental Assessment (EA) be conducted under National Environmental Protection Act (NEPA).

2 REGULATORY FRAMEWORK

2.1 Migratory Bird Treaty Act

The regulatory framework for protecting birds includes the Migratory Bird Treaty Act (MBTA) and Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds). The MBTA is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation. The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means or in any manner, to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird" (16 United States Code [USC] 703). The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 Code of Federal Regulations [CFR] 10.12). The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

2.2 Bald and Golden Eagle Protection Act

The BGEPA specifically protects bald eagles and golden eagles. Under authority of the BGEPA (16 USC 668–668d), bald and golden eagles are afforded additional legal protection. The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, transport, export, or import, at any time or in any manner, of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof (16 USC 668). The act also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 USC 668c), and includes criminal and civil penalties for violating the statute (see 16 USC 668). The term "disturb" is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (50 CFR 22.3).

On September 11, 2009, the USFWS established two new permit types under the BGEPA: 1) permits for take of bald and golden eagles that is associated with, but not the purpose of, the activity (50 CFR 22.26) and 2) permits for purposeful take of an active or inactive eagle nest where necessary to alleviate a safety emergency; an inactive eagle nest when the removal is necessary to ensure public health and safety; an inactive nest that is built on a human-engineered structure and creates a functional hazard that renders the structure inoperable for its intended use; or an inactive nest, provided the take is necessary to protect an interest in a particular locality and the activity necessitating the take or the mitigation for the take will, with reasonable certainty, provide a clear and substantial benefit to eagles (50 CFR 22.27).

To facilitate issuance of eagle incidental take permits (ITP) for wind energy facilities, the USFWS finalized the *ECP Guidance*. If eagles are at potential risk, developers are strongly encouraged to follow the recommended *ECP Guidance* for development of their projects. The *ECP Guidance* describes specific actions that are recommended to achieve compliance with the regulatory requirements in the BGEPA for an eagle take permit, as described in 50 CFR 22.26 and 22.27. The *ECP Guidance* provides a national framework for assessing and mitigating potential risk specific to eagles through development of ECPs and issuance of programmatic eagle take permits for eagles at wind energy facilities. AEM has developed this ECP in consultation with the USFWS to avoid and minimize potential impacts to eagles, mitigate for unavoidable impacts.

The USFWS has recently developed a process for issuing new permits for take of bald and golden eagles at wind energy facilities (50 CFR 13 and 22) and recommends that project proponents prepare an ECP to avoid, minimize, and otherwise mitigate project-related impacts to reduce eagle take to the "no net loss" standard stipulated in the Final Take Permit Regulations under 50 CFR 22.26 and 22.27. USFWS authorities are codified under multiple statutes that address management and conservation of natural resources from many perspectives, including, but not limited to the effects of land, water, and energy development on fish, wildlife, plants, and their habitats. The Eagle Act (16 U.S.C. 668–668e) and its regulations (50 CFR Part 22) authorizes the USFWS to issue ITPs only when the take is compatible with the preservation of each eagle species, defined in the Programmatic Environmental Impact Statement (USFWS 2016a) as "consistent with the goals of maintaining stable or increasing breeding populations in all eagle management units (EMU) and the persistence of local populations throughout the geographic range of each species." In addition, a full list of authorities that apply to this action are located in the PEIS (USFWS 2016a).

2.3 Other Laws, Regulations, and Policies

The Wildlife Conservation Act (17-2-37 through 17-2-46 New Mexico Statutes Annotated 1978) provides the New Mexico Department of Game and Fish (NMDGF) the authority and responsibility to protect, manage, and conserve species of wildlife indigenous to the state. The legislature directed the NMDGF to manage to maintain or to the extent possible enhance numbers of species found to be threatened or endangered within the carrying capacity of the habitat.

A summary of the distribution, current status, threats (existing, past, or future actions that can create uncertainty of species persistence if they are not carried out in a manner that considers wildlife and habitat needs), and recommendations regarding listing status and conservation actions are presented for each species or subspecies on the state's biennial review. The most recent review was issued in August 2014.

2.4 LAND-BASED WIND ENERGY GUIDELINES

Concern regarding the impact of wind development on environmental resources during both short-term construction and long-term operation prompted the USFWS to issue its voluntary interim guidelines in 2003. These guidelines advised developers on recommended methods to assess, develop, and site their projects to reduce adverse effects to environmental resources, particularly fish and wildlife. In 2007, the Wind Turbine Guidelines Federal Advisory Committee was established by the USFWS to review and make recommendations going forward on improvements to the interim guidelines. The committee's final recommendations, submitted in 2010, were subsequently used by the USFWS to develop a new set of voluntary guidelines for public comment and review, resulting in the release of the draft *Land-Based Wind Energy Guidelines* in July 2011. Following additional revisions, a final version was released on March 23, 2012.

The *Final Guidelines* outline effective measures to avoid or minimize impacts to wildlife and their habitats from wind energy facilities. They also encourage reviewing agencies and other professionals to complete five tiers of analysis to determine impacts and design avoidance and minimization strategies. The key laws, regulations, and guidelines have been closely followed in order to develop the project study design and the conservation measures to protect eagles during construction and operation. These measures are also detailed in the revised BBCS (Hawkpoint Environmental Consulting 2019).

2.5 COMMUNICATION WITH THE U.S. FISH AND WILDLIFE SERVICE

AEM initiated communication with the USFWS New Mexico Ecological Services Field Office, the USFWS Region 2 Division of Migratory Birds, and the NMDGF regarding this project in April 2011 (meeting notes in Appendix A). Prior to the meeting, AEM provided the USFWS with the project description, endangered species assessment table, critical issues analysis, and avian baseline report. The meeting was attended by the USFWS's Laila Lienesch, Bob Murphy, and Chris O'Meilia. USFWS staff raised a concern about the presence of prairie dogs (*Cynomys* sp.) and suggested AEM contact Jim Stuart (NMDGF). USFWS staff also recommended additional winter surveys be conducted at fixed points and of longer duration. They also recommended AEM document nesting raptors at the site and develop a project Avian and Bat Protection Plan (ABPP). AEM subsequently contacted Mr. Stuart on May 3, 2011. Mr. Stuart responded with an e-mail on May 5, 2011, stating he was unaware of any prairie dog colonies in the footprint area.

AEM sent a separate letter to the NMDGF requesting comments on the proposed project. AEM received a review letter from Rachel Jankowitz (previously with the NMDGF) dated May 6, 2011. The letter asked for additional information on habitat and avian resources, including raptors, lesser prairie-chicken (*Tympanuchus pallidicinctus*) and long-billed curlew (*Numenius americanus*). AEM responded in a May 16, 2011, letter to Ms. Jankowitz with an updated summary of survey data collected.

On May 8, 2011, AEM conducted a raptor nesting survey of the project area. A summary of the survey was sent to Laila Lienesch and Rachel Jankowitz on July 7, 2011.

An ABPP was submitted to Leila Lienesch (USFWS) on August 29, 2012. AEM requested a review of the proposed project in order to determine the best course for proceeding in environmental compliance.

Through further discussions with Bob Murphy, it was decided that AEM would produce an ECP in addition to the ABPP (now a BBCS). A draft ECP was submitted to Bob Murphy in August 2013. Mr. Murphy provided comments on the ECP in September 2013.

SWCA and Doug Krause (formerly of AEM) met with Bob Murphy, Deb Hill, and Ty Allen (by phone) on November 10, 2014. Additional concerns regarding prairie dogs and lesser prairie-chickens were raised. The USFWS recommended lesser prairie-chicken surveys be conducted in April 2015. It was suggested that Grant Beauprez (NMDGF) be contacted regarding lesser prairie-chickens. Mr. Beauprez provided updates on lek locations to SWCA's Pete David. Surveys were conducted as recommended, which are addressed in this document.

In April 2015, Pete David of SWCA discussed with Bob Murphy the company's intent to complete and resubmit a final BBCS and ECP and to conduct additional winter surveys following the wind energy guidelines protocol. Mr. Murphy was consulted regarding potential golden eagle use of the area. Mr. Murphy subsequently provided telemetry data from the fall of 2012 showing a juvenile golden eagle occupying an area primarily east and southeast of Tatum with infrequent flights into the project area.

AEM and SWCA met with Bob Murphy and Jennifer Davis (USFWS) to discuss the results of the BBCS and eagle fatality model, the status of the ECP, and the proposed post-construction monitoring. There was general agreement that the project would represent a low-end Category 2 risk to eagles. The meeting notes are included in Appendix B.

A BBCS draft was submitted to Jennifer Davis on May 12, 2016.

An ECP draft was submitted to USFWS in April 2016. Several revisions followed including the July 2017 draft that included updates based on comments received from Bob Murphy in June 2017.

3 PROJECT DESCRIPTION

3.1 PROJECT LOCATION

The Sterling Wind Project site is located in Lea County in the southeast portion of New Mexico (Figure 3.1). It is situated on private property approximately 8 km (5 miles) north of Tatum, New Mexico. US Highway 380 occurs 8 km (5 miles) south of the project site. New Mexico Highway 125 forms the eastern boundary of the project area, and New Mexico Highway 206 forms the western boundary.

3.2 PROJECT INFRASTRUCTURE

AEM Wind, LLC, a wholly-owned subsidiary of Akuo Energy USA, Inc., initiated operation of the wind project in July 2017 on private lands approximately 8 km (5 miles) north of the city of Tatum, New Mexico (see Figure 3.1). AEM initially proposed a 250-megawatt (MW) project on 8,935 ha (22,000 acres), utilizing between 100 and 110 turbines. The original project was reduced to a 30-MW project on 2,025 ha (5,000 acres) deploying 13 turbines (Figure 3.2 and Figure 3.3). The project infrastructure consists of 13 General Electric GE 2.3-116 turbines (80-m [262.5-foot] hub height, 56.9-m radius [186.7-foot] blade), a new 0.2-ha (0.5-acre) substation, nearly 7.3 km (4.5 miles) of new roads, 12.7 km (7.8 miles) of collection lines, and one permanent meteorological tower (see Figure 3.2). Construction of the project required standard wind farm construction activities, including

- road and pad development;
- construction of foundation and footings for turbine towers;
- trenching for collector line installation;
- pole placement and conductor stringing for overhead portions of the collector line and the transmission line;
- tower assembly, erection, and equipment installation;
- final road grading;
- implementing erosion control; and
- site clean-up.

The turbines were placed in one east-west-oriented row, with two north-south branches accessed by gravel and dirt roads. AEM operates a substation at the site in order to step up the power generation and facilitate the interconnection.

Where necessary, ranch roads were improved by adding a mix of caliche and aggregates, and possible cement for stabilization. The roads are 4.8 m (16 feet) wide with 3.0 m (10 feet) of compacted shoulders to accommodate cranes and other large equipment. The new access roads will be left in place, but the shoulders have been degraded and reseeded.

Crane pads are approximately 40 × 20 m (131 × 66 feet) at each turbine location. The pads measure 18 to 30.5 m (60–100 feet) in diameter, with a 6-m (20-foot) radius of permanent gravel; the remainder was reseeded.

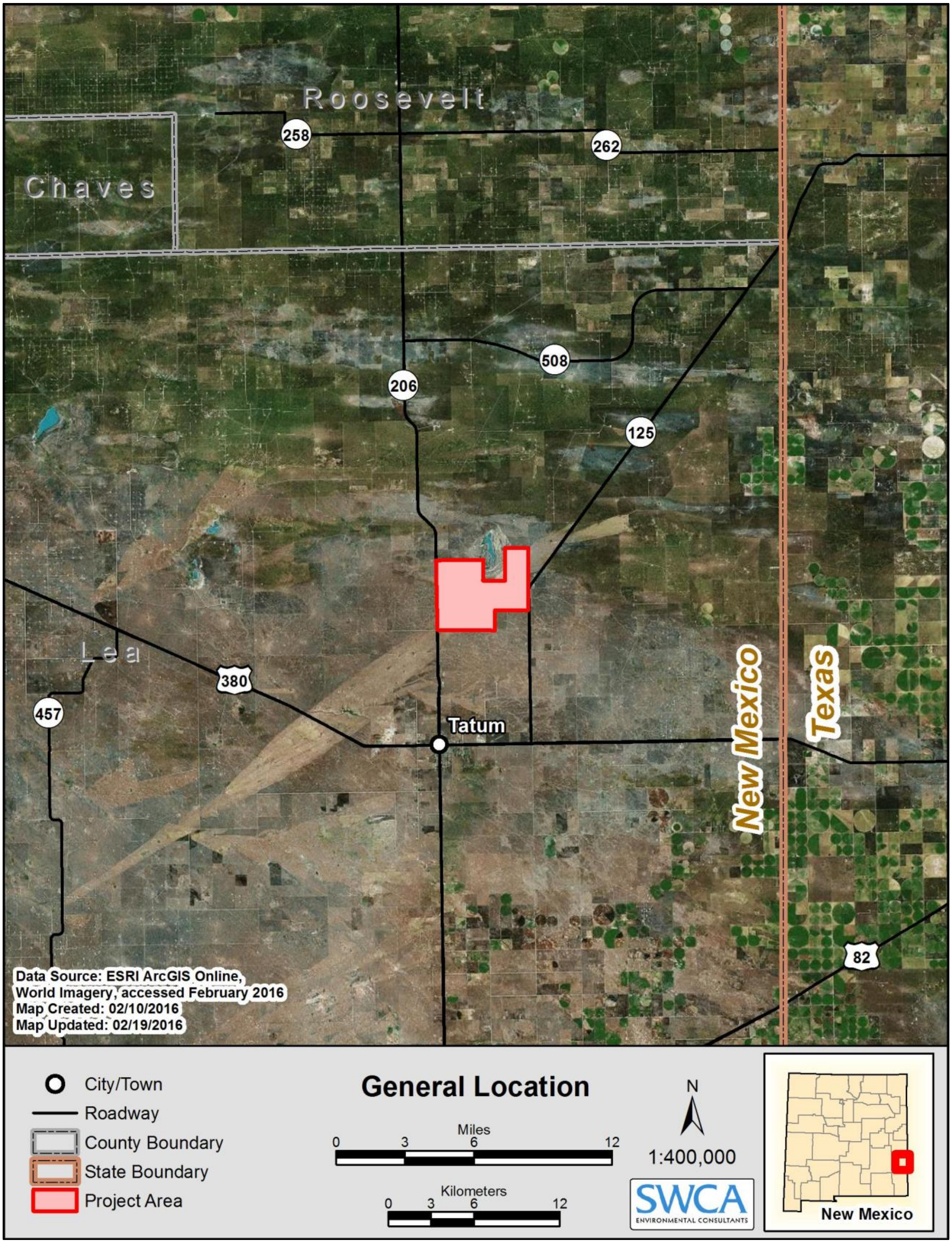


Figure 3.1. Location of the Sterling Wind Project.

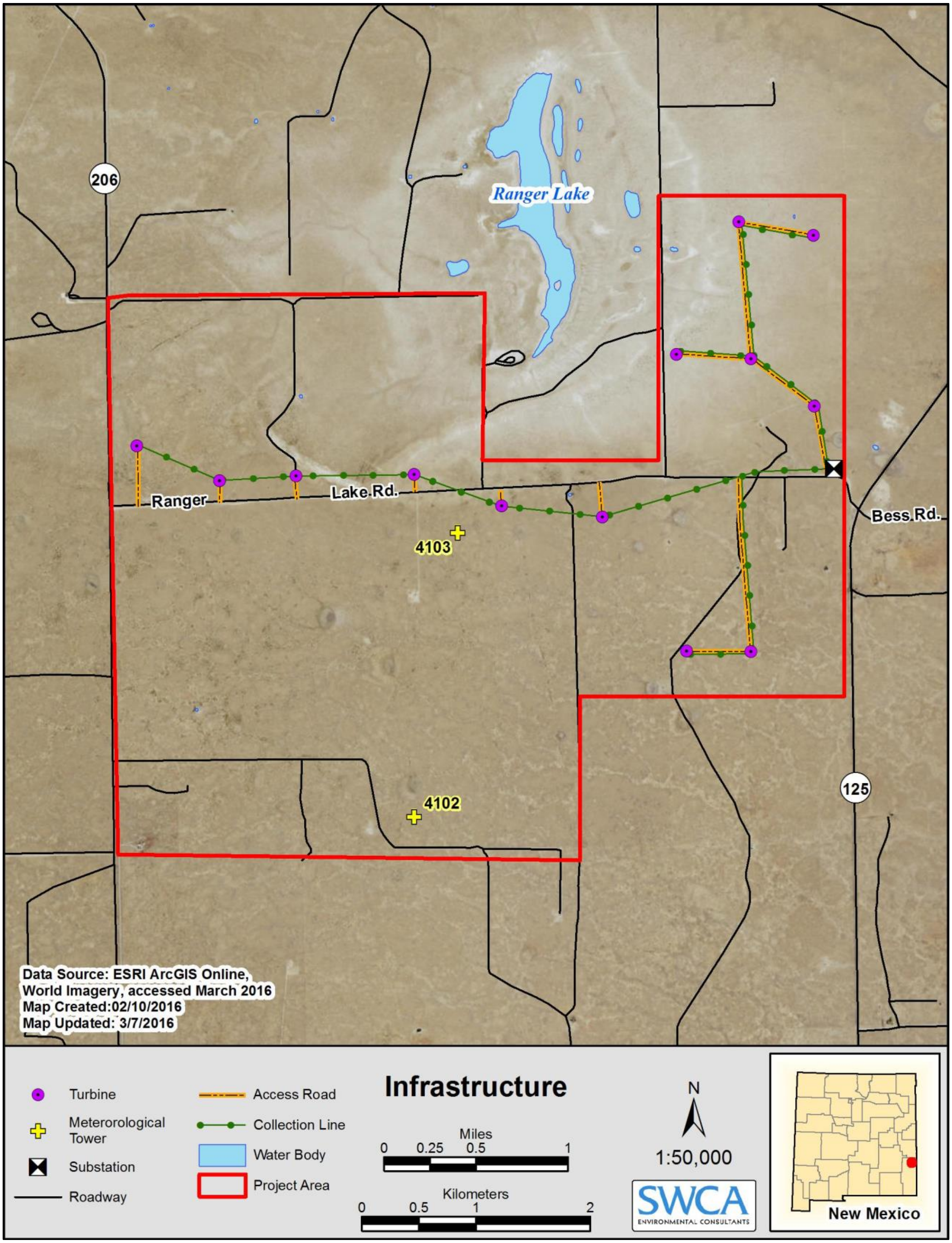


Figure 3.2. Sterling Wind Project infrastructure.

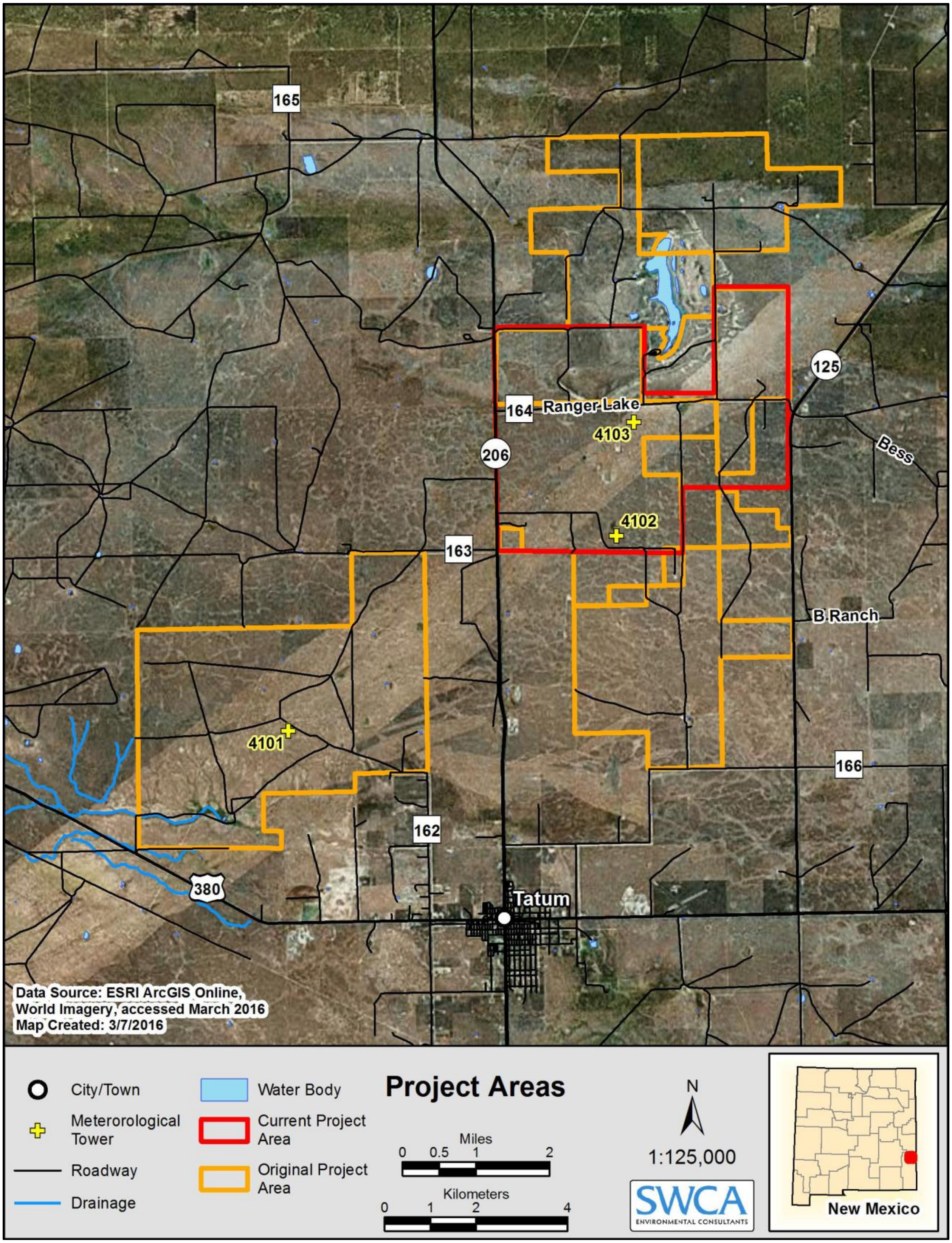


Figure 3.3. Comparison of previous and current project areas.

3.3 LAND OWNERSHIP

Ownership of land within the project area boundary is designated as unincorporated private, with a single landowner. The land has never been developed and is currently used exclusively as grazing land for beef cattle. An existing 69-kV electric transmission line borders the eastern boundary of the site parallel to New Mexico Highway 125.

3.4 ENVIRONMENTAL SETTING

The project is located in the High Plains Arid Llano Estacado ecoregion. This region is a level, elevated plain with few streams, but many ephemeral pools. The region typically has little winter precipitation and, with a caliche layer close to the land surface, the area is subjected to persistent drought conditions (Griffith et al. 2006). Common soil series for this ecoregion include the Lea, Kimbrough, Sharvana, Duoro, Faskin, Stegall, Slaughter, and Conger series.

The region is characterized by grassland and shrubland. The natural shortgrass prairie vegetation for the region includes blue grama (*Bouteloua gracilis*), black grama (*B. eriopoda*), buffalograss (*B. dactyloides*), silver bluestem (*Bothriochloa saccharoides*), sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida* sp.), Arizona cottontop (*Digitaria californica*), hairy tridens (*Erioneuron pilosum*), muhly (*Muhlenbergia* sp.), bottlebrush squirreltail (*Elymus elymoides*), and sand sagebrush (*Artemisia filifolia*). Common shrubs include mesquite (*Prosopis* sp.), narrowleaf yucca (*Yucca angustissima*), juniper (*Juniperus* sp.), and ephedra (*Ephedra* sp.). The major land use for the ecoregion is ranching and livestock grazing, oil and gas production, and a small amount of irrigated cotton, grain sorghum, and wheat (Griffith et al. 2006). The area would naturally support the Plains-Mesa Grassland community of east-central New Mexico as described by Dick-Peddie (1993).

4 INITIAL SITE ASSESSMENT (*ECP GUIDANCE STAGE 1*)

The original screening analysis determined that there was potential for golden eagles to migrate through and winter in this part of the state, but breeding eagles were not expected. No winter habitat for bald eagles is present at the site.

4.1 RISK TO EAGLES BASED ON SITE CATEGORIZATION

Based solely on the preliminary screening information, the project did not appear to qualify as a Category 1 under the *ECP Guidance*. This initial assessment determined that nesting habitat for eagles was absent in the project or surrounding regional area. With the exception of Carlsbad Caverns National Park, the southeastern portion of the state has been generally excluded from breeding distribution for golden eagles (Cartron 2010). The area does not appear to contain an important breeding area, but there is potential for eagles to winter in the area. Scattered prairie dog colonies are present in the area that might attract raptors, including golden eagles, to the project footprint or the immediate surrounding area.

There is no information indicating that the area occurs within a migratory pathway, although some birds may be expected to pass through the area during migration. There are no mountains or other ridges in the project area that would be used by migrating birds. There is evidence of wintering populations of golden eagles in east-central and southeastern New Mexico (Cartron 2010). Without the benefit of having information on the local area eagle population, further analysis needed to categorize the risk was not conducted at the site categorization phase, but an assessment of project-level take is included in Section 7.2.2. However, subsequent information collected on eagle nesting and use did not indicate that the project posed an "obvious, substantially high risk to eagle populations" as required for a Category 1 designation.

Although bald eagles also winter in New Mexico, they are mostly confined to river systems or reservoirs (Cartron 2010). No breeding habitat is known in Lea County or any of the surrounding counties.

Category 2 indicates high to moderate risk, but recognizes that there are opportunities to mitigate impacts and minimize risk to eagles. None of the information reviewed identified the project area as an important corridor for eagle migration, but recognized the possible presence of wintering birds. Critical nesting habitat did not appear to be located in the project or surrounding area. A Category 3 designation is one that USFWS defines as a project with minimal risk to eagles. These projects may not warrant the submittal of an eagle take permit application, supported by the results of an ECP. Additional analysis for categorization was conducted following the collection of site-specific surveys and modeling. The results provided are in Section 7.2.

5 SITE-SPECIFIC SURVEYS AND ASSESSMENTS (*ECP GUIDANCE STAGE 2*)

Avian point counts were conducted in the project area by Ecosystem Management, Inc. from March 2009 to February 2010 (Ecosystem Management, Inc. 2010). The point counts were completed using the variable circular plot methods as described by Reynolds et al. (1980) with 12 observations stations and an 800-m (2,625-foot) radius circle centered on each point. The points were surveyed for 30 minutes every 2 weeks from mid-March to July 2009 (spring migration) and mid-September to mid-November 2009 (fall migration), and once a month in December 2009 and February 2010 for winter residents (see report in Appendix C). In total, 252 surveys were conducted (126 hours).

Winter raptor surveys were initiated on 5 days during the 2010–2011season at 20 points (Ecology and Environment, Inc. 2012). The length of survey period on December 15, 2010, was 20 minutes, with the subsequent four surveys being reduced to 15 minutes. In total, 1,600 minutes (26.67 hours) were surveyed. Besides raptors, presence of other bird species was also recorded (see Appendix D).

After consultation with Robert Murphy (USFWS Region 2 Migratory Bird Office), additional surveys for wintering raptors were conducted specifically to determine eagle use of the area. SWCA conducted 26 days of additional surveys beginning in September 2015 and ending in March 2016. One survey (2 days) was completed in September, and two surveys (4 days) were conducted in October, November, and December. Due to access limitation from snow, no surveys were conducted in January. Three surveys (6 days) were completed in both February and March. Specific survey objectives were to establish the relative distribution and abundance of fall migratory and wintering birds, focusing on raptors. SWCA initiated 1-hour avian surveys using 800-m-radius (2,625-foot-radius, circular plots at seven points (Figure 5.1). These plots were located within the original project area to represent the major habitat types and to provide maximum visibility. Each survey lasted 1 hour, with all birds observed being recorded in the first 10 minutes, but the remaining time was devoted to large birds as recommended in the *Final Guidelines* (USFWS 2012). Surveys were conducted between 8:30 a.m. and 3:00 p.m., and the order in which plots were surveyed was rotated to avoid a consistent pattern. Ninety-one hours of surveys were completed. Raptors observed within 800 m (2,625 feet) horizontal and 200 m (656 feet) vertical from the center of the plots were considered as being within the survey area. Distances were calibrated with local landmarks.

The surveys were established in attempt to sample representatively the initial project area of 8,910 ha (22,000 acres). The project area easily covered the footprint including turbines, roads and other infrastructure with a 1-km (0.6-mile) buffer. Subsequently, the project was substantially reduced to an area approximately 2,025 ha (5,000 acres) in size (see Figure 3.3 above). However, the remaining points nearly cover 30% of the final project area and the points are representative of the available habitat. The revised project area was overlapped by three raptor points, but they accurately represented the habitat throughout the original and revised project areas.

AEM used the draft *ECP Guidance* released in 2011 and most recently the second version released in April 2013 to direct the environmental assessments conducted at the project site, as well as to determine the project risk to eagles. The *ECP Guidance* uses a tiered approach similar to the USFWS *Final Guidelines* for decision-making throughout the development stages of a wind energy facility. The steps taken to fulfill with these stages are summarized below in Table 5.1.

Table 5.1. Actions Taken by AEM to Comply with the USFWS *ECP Guidance*

Stage	Objective	Actions	Data Sources
1	Identify potential wind facility locations with manageable risk to eagles.	AEM contracted Ecology and Environment, Inc. to conduct a critical issues analysis and site reconnaissance visit.	NMDGF correspondence, NMDGF and USFWS protected species listings, New Mexico Ecoregions Map, U.S. Geological Survey National Hydrography Dataset, public bird counts, and migratory route information.
2	Obtain site-specific data to predict eagle fatality rates and disturbance take at the proposed project site.	Ecosystems Management, Inc., Ecology and Environment, Inc., and SWCA conducted point-count surveys, raptor nest searches, and habitat assessments.	Baseline Avian Study (August 2010), Nest Site Survey and agency letter (July 2011), Avian Database Review, Winter Raptor Report (2012), Winter Raptor Surveys (2015–2016).
3	Using the USFWS's Bayesian model, estimate the fatality rate (upper 80% confidence limit) of eagles for the project.	AEM contracted SWCA to model annual fatality rates for a 30-year project duration.	See Section 7 (Predicting Eagle Fatality).
4	Identify and evaluate conservation measures and advanced conservation practices that might avoid or minimize fatalities and disturbance effects identified in Stage 3.	AEM completed a BBCS and this ECP to document conservation measures implemented during the development, construction, and operational phases of the project.	See Section 8 (Avoidance and Minimization of Risk).
5	Conduct post-construction monitoring to document any operation-related fatalities.	As part of this ECP, AEM developed a 2-year monitoring plan approved by the USFWS.	AEM will maintain a fatality database and provide data to the USFWS.

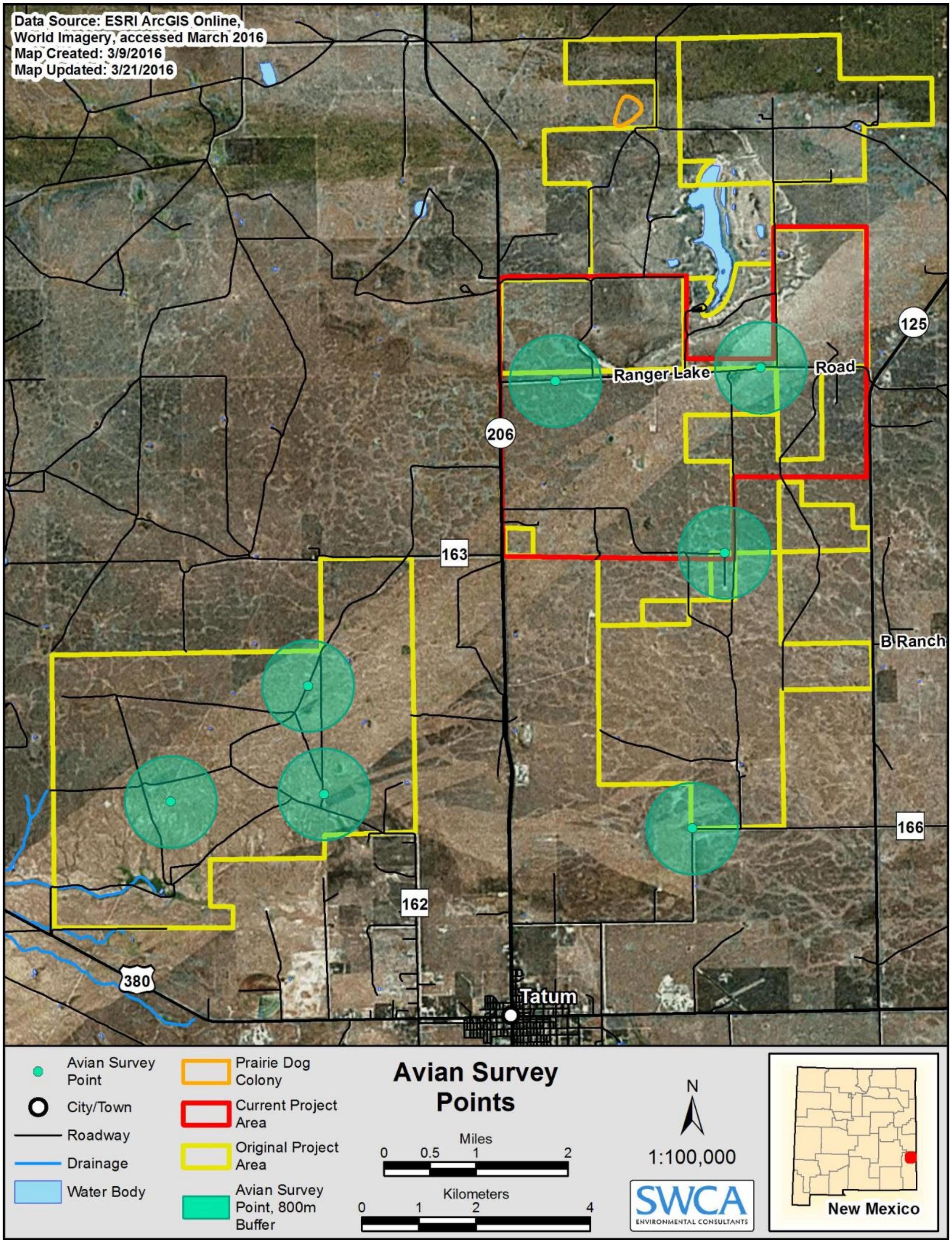


Figure 5.1. Location of avian survey points.

5.1 Eagle Use

In 2002 the Cornell Lab of Ornithology and National Audubon Society developed eBird, an electronic database of bird sightings, to provide data sources for basic information on bird abundance and distribution. The eBird database uses a web interface to allow users to query data based on temporal and spatial fields. Based on these data it was determined that both bald and golden eagles may be observed throughout the year, but the majority of recorded sightings occurred during the winter. The data support that the eastern and southeastern plains of New Mexico attract wintering golden eagles.

The majority of bald eagles that winter in New Mexico are adults, and they are typically confined to rivers and reservoirs (Cartron 2010). No bald eagles were recorded during surveys on the project area.

Avian surveys conducted in 2009–2010 (Ecosystem Management, Inc. 2010) recorded golden eagles in the original project area (22,000 acres). A single observation occurred in both the spring and fall, but the majority of sightings (6) were in the winter; two of these were birds that were in flight. Data from these surveys are not included in Table 5.2 below since the raw survey data were not available from the report.

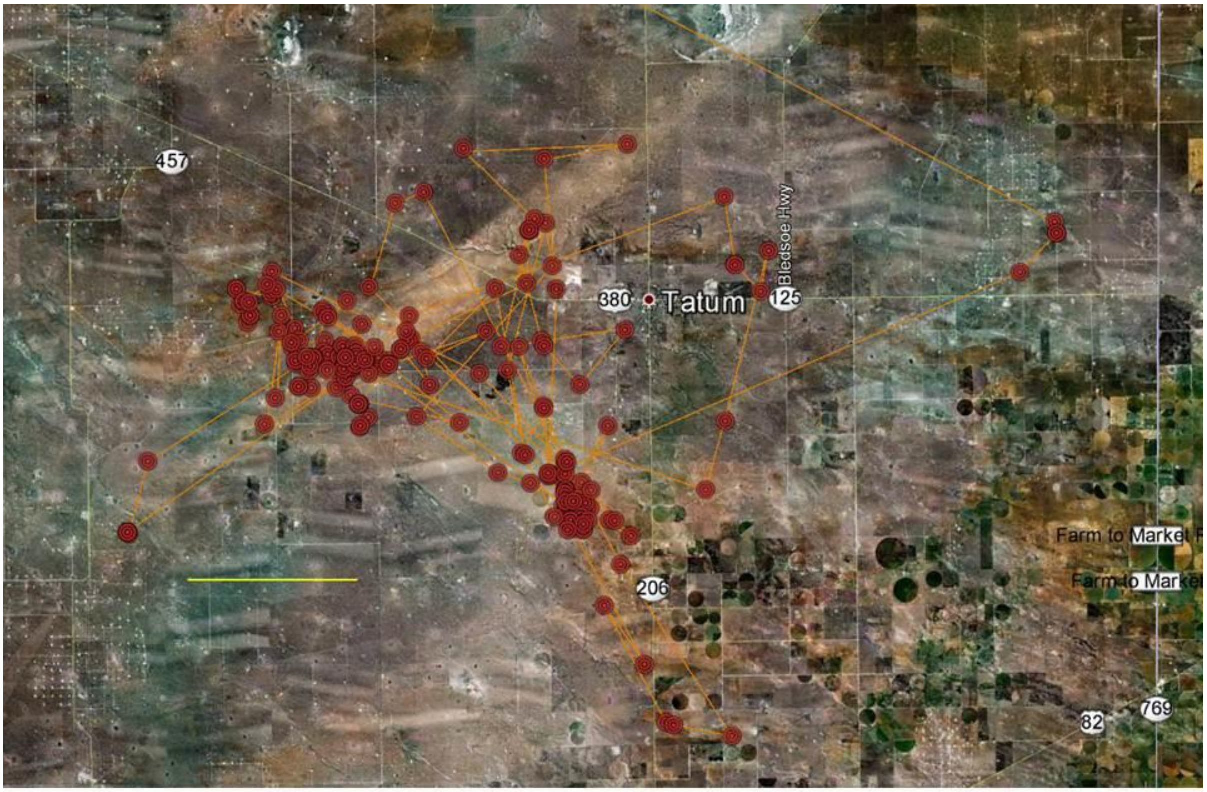
Winter surveys completed in December, January, and February 2010–2011 also observed golden eagles in the western and south-central portion of the original project area (Ecology and Environment, Inc. 2012). All the birds observed were juveniles or sub-adults and most were perched on power lines (Table 5.2).

Data for tagged juvenile golden eagles in the fall of 2011 and fall/winter 2015-2016 showed a similar preference for the area south and west of the project (Figure 5.2, provided by the USFWS's Bob Murphy). This bird made infrequent flights through or to the original project area. During the 2015–2016 avian surveys, no golden eagles were observed in the original project area, but a juvenile golden eagle was regularly observed along U.S. Highway 380, 16 km (10 miles) west-southwest of the current project area.

Table 5.2. Summary of Winter Raptor Surveys, 2010–2016

Month	Survey Hours	Eagle Minutes	Eagle Observations
September 2015	7.0	0	0
October 2015	14.0	0	0
November 2015	14.0	0	0
December 2010	10.0	4	5*
December 2015	14.0	0	0
January 2011	10.0	0	1*
February 2011	5.0	0	2*
February 2016	21.0	0	0
March 2016	21.0	0	0
Totals	**116.0[1]**	**4**	**8**

[1] Does not include hours from 2009–2010 (Ecosystem Management, Inc. 2010).
*Includes perched birds.



GPS location track for #077 juvenile male golden eagle, 17 Oct-19 Nov 2011. Eagle dispersed from nest in nw NM early Oct 2011, arrived at Tatum area 17 Oct, was killed at distribution line west of Tatum 19 Nov 2011. Yellow bar = 5 miles. [R. Murphy, USFWS. **Not for distribution**]

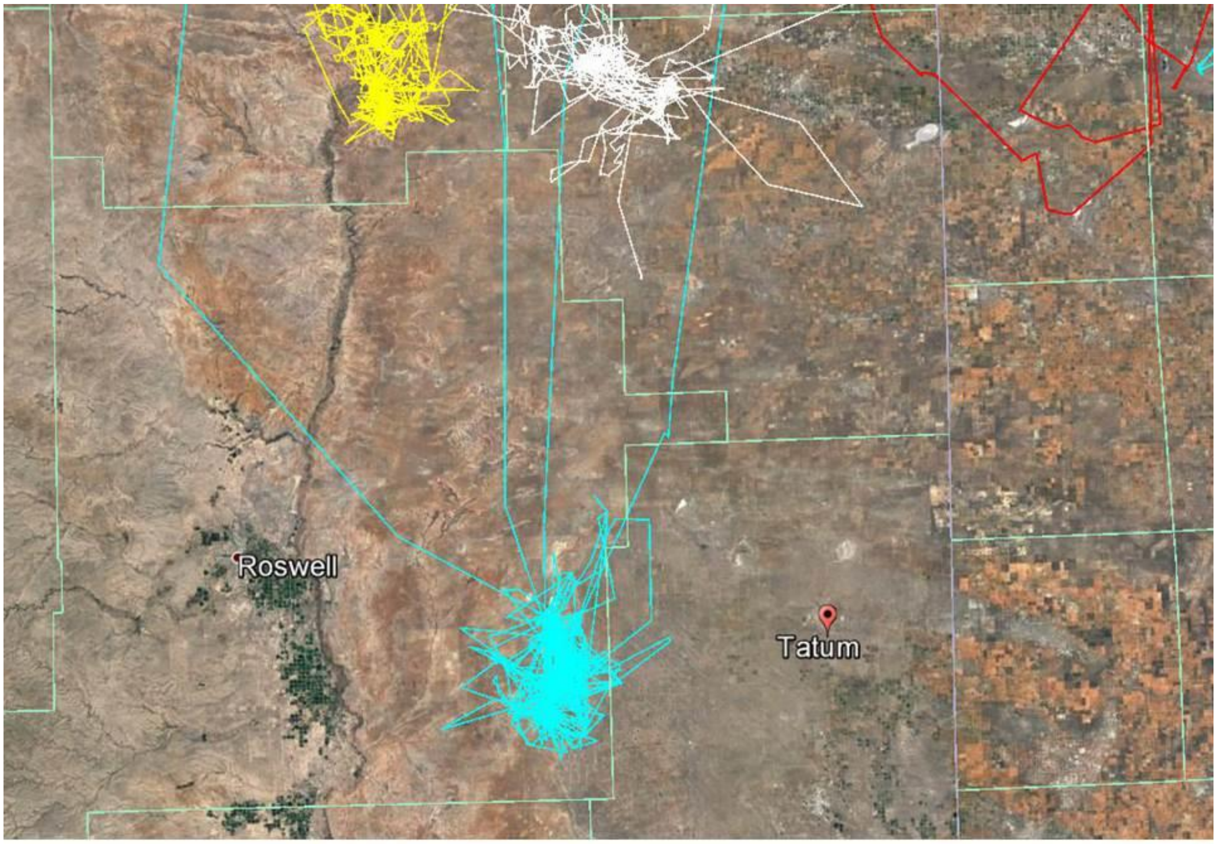


Figure 5.2. Tagged juvenile golden eagle dispersal, 2011 (top) and 2015-2016 (bottom).

5.2 Eagle Nests

Conversations with raptor biologists indicated that no golden or bald eagles are actively nesting within Lea County (Jean-Luc Cartron, personal communication, April 23, 2014). The project area does not fall within the breeding range of the golden eagle (Kochert et al. 2002). Lea County is considered a non-breeding distribution area for both eagle species (Cartron 2010).

5.3 Eagle Prey Base Assessment

Potential golden eagle prey populations appeared to be concentrated in one prairie dog colony located in the northern part of the project area. Regular observations by SWCA biologists of this colony between 2014 and 2016 noted a general decline in the number of animals present. Most recent surveys in March 2016 detected only two active prairie dog burrows. Although the colony may still be active, the low numbers of prairie dogs would be less likely to attract eagles to the project area. A second small colony was identified by AEM staff during a nesting survey of the area in 2011. Recent visits have failed to discover any evidence of a prairie dog colony in this location. Landowners were also unaware of any colonies at this location.

All the roads in the project footprint are unimproved. Improvements would not include paving that might encourage higher speeds and increase the potential for road kills that would attract eagles. No road kills were observed during any of the survey periods. Pronghorn (*Antilocarpa americana*) are common in the area, but no hunting is currently allowed on the private lands. These mammals are reluctant to cross major highways or more rural roads with fencelines that prevent pronghorn from passing underneath barbed wire (Ockenfels et al. 1994; Bristow et al. 2013), which would reduce the risk of their becoming victim to vehicle collisions. The county roads traversing the project area have sections of fence that could prevent pronghorn from crossing and theses roads have less traffic volume, which may reduce the risk for collisions. Therefore, pronghorn carcasses are not likely to attract scavenging eagles.

Cattle were present throughout the survey period, although in very low numbers. The range around the project area is relatively healthy, indicating stocking rates are low. Although stocking rates are low, some calves may be present as a food source for scavenging eagles. Due to healthy range conditions and good livestock management by the landowners, cattle carcasses that might attract eagles would be rare.

There are no large lakes or rivers in Lea County that would support fish populations. The nearest wintering population would likely be along the Rio Grande over 200 miles to the west or the upper Pecos River over 100 miles to the northwest (Catron 2013). Breeding has only been documented recently from the northernmost counties in New Mexico (Catron 2013).

5.4 Eagle Risk Categorization

During initial coordination with the USFWS, the project was not specifically designated as a Category 2 site, which would indicate a high to moderate risk to eagles. In September 2012, the USFWS's Bob Murphy indicated that additional surveys for golden eagles would be needed for the site to be considered as a Category 3 (low-level risk). Per USFWS *ECP Guidance* (USWFS

2013), there are three factors that influence this categorization. These have been evaluated for this project based on the results of this ECP and are included in Table 5.3.

Table 5.3. Evaluation of the ECP Guidance Factors for Eagle Risk

Category 3 Eagle Risk Factors	ECP Results
1. Project has an important eagle use area or migration concentration site within the project area, but not in the project footprint.	The survey data do not provide evidence that the project footprint area represents an important eagle use locale or contains a migratory concentration site
2. Project has a species-specific uncertainty-adjusted fatality estimate between 0.03 eagle per year and 5% of the estimated species-specific local area population size.	The species-specific fatality estimate based on the USFWS Version 3 model was 0.099 above the 0.03 annual target. A mortality rate of one golden eagle per 10 years comprises less than 0.001% of the total estimated local area population.
3. Project causes cumulative annual take of the species-specific local area population of less than 5% of the estimated local area population size.	The project's estimated fatality is 0.003% of the local area 5% benchmark for annual golden eagle mortality.

The project meets the criteria of Eagle Risk Factor 1. Previous evidence suggests golden eagles winter in the area, but generally west of the project area and not in large concentrations. Golden eagles are not known to breed in the area and there are no physical geological formations that would support a mass migration through the area.

Based on fatality modeling (see Section 7), the project exceeds 0.03 annual eagle fatality estimate based on Version 3 of the USFWS fatality model (Eagle Risk Factor 2). Based on the limited data regarding local area eagle populations, it would appear that the fatality estimate would be well below the 5% estimated species local area population size, and the cumulative annual take would also be well below the 5% as necessary for a Category 3 designation (Eagle Risk Factor 3).

Based on a "weight of evidence" approach using the *ECP Guidance*, the site-specific data collected to date, and the risk assessments, the project appears to meet a low Category 2 designation, based on the annual fatality estimate. Category 3 projects are those that pose little risk to eagles and may not warrant an application for an eagle take permit. This ECP provides documentation of the relatively low risk to eagles and outlines mortality monitoring (provided in more detail in the BBCS [Hawkpoint Environmental Consulting 2019]) to assess actual impacts. This ECP outlines a plan of action to mitigate for take and to minimize future risk to golden eagles. Through consultation with the USFWS, a final ECP would be submitted to enable AEM to pursue an eagle incidental take permit.

The risk factors and the science behind the risk factors have been adopted from the *ECP Guidance* (USFWS 2013). An assessment of the factors known or thought to be associated with increased probability of collisions between eagles and wind turbines (other than abundance) include two main risk factors identified in the guidance; 1) the interaction of topographic features, season, and wind currents that create conditions for high-risk flight behavior near turbines, and 2) behavior that distracts eagles and presumably makes them less vigilant (e.g., active foraging or inter- and intra-specific interactions such as territorial defense). Golden eagles were not present during any of the 2015–2016 surveys or during any of time in which biologists were in the project area. In addition, no known nesting sites are located within 50 km (31 miles) that might produce interactions among breeding birds. However, eagles were observed at least 16 km (10 miles) to the southwest of the project area and had been recorded in the project area during past surveys. During winter, eagles are observed regularly 4-10 miles south of the project.

5.4.1 Topography and Wind

The project footprint is relatively flat. The prevailing wind direction is primarily to the south, southwest, south, and south-southeast (wind blowing primarily out of the north) greater than 50% of the time. Wind direction is critical for eagles during migration, but is usually associated with topography that creates favorable flight conditions. Since no observations were made of eagles in flight in the project area, it is difficult to predict how wind direction might affect birds in the area.

5.4.2 Intra-specific Interactions and Foraging Behavior

There is the potential for eagles to winter in the project area. Previous year's surveys detected eagles in the project area, primarily in the southwest portion of the original project area. No eagles were observed in the project area during the 2015–2016 survey period. Eagles were consistently observed during the winter along U.S. Highway 380, approximately 10 miles west-southwest of the project area. The project area does not appear to contain a concentrated food source that would represent high-quality foraging habitat for eagles. No known eagle nests are located within 50 km (31 miles) of the project and the project is located outside what would be considered nesting range for the species (Cartron 2010). Assuming that intra-specific competition and territorial defense increase collision risk (USFWS 2013), these behaviors are unlikely to occur within the project area due to the lack of active breeding territories.

6 AVOIDANCE AND MINIMIZATION OF RISKS IN PROJECT SITING (*ECP GUIDANCE STAGE 4*)

6.1 Project Planning/Design Phase: Site Selection

There were no alternative sites considered for this wind development. The preliminary analysis and data collection show that golden eagles may winter in the area, but no nesting occurs in this region of New Mexico

The initial project area included two phases of development covering 8,935 ha (22,000 acres). However, the size of the project has been subsequently downsized by 75% to 2,025 ha (5,000 acres) containing only 13 turbines (see Figure 3.3). Given the low use of the project area by wintering eagles and the small number of turbines, the risk of eagle fatalities has been substantially reduced compared to the original project.

7 PREDICTING EAGLE FATALITIES (*ECP GUIDANCE STAGE 3*)

7.1 METHODS AND ASSUMPTIONS

Fatality estimates presented in this analysis were derived from a combination of 15-minute, 30-minute, and 1-hour survey periods. The former baseline surveys conducted in 2010 consisted of 30-minute surveys. The 2016 surveys were extended to 1 hour to be consistent with the *ECP Guidance* (USFWS 2013). Surveys conducted in 2011 and 2016 focused on winter raptors when golden eagles would be expected to be present. Although the 2011 and 2012 surveys used an 800-m (2,625-foot) radius point-count area, neither effort recorded eagle minutes, or if they did, the data were not available in the reports for analysis. Most of the observations involved perched eagles, but where the eagles were recorded flying in the project area below the 200-m (656-foot) altitude the data were included as 1-minute of eagle flight in the fatality analysis below.

Estimating potential eagle fatalities at wind facilities is a core component of the requirements for assessing environmental impacts in the *ECP Guidance* (USFWS 2013). The *ECP Guidance* recommends use of a Bayesian framework developed by the USFWS to predict the annual fatality rate that uses explicit models to define the relationship between eagle exposure (determined by surveys), collision probability, and fatalities, and to account for uncertainty. Eagle fatality for the wind development is calculated as a product of three components: eagle exposure (λ), probability that exposure results in a collision (C), and an expansion factor (ε) for scaling the estimate to a given number of daylight hours within a defined hazardous area. Therefore, fatality is estimated as:

$$Fatalities = \lambda \times C \times \varepsilon.$$

The probability that exposure results in collision is based on data collected from existing wind facilities (priors). SWCA used the Draft USFWS Collision Fatality Model Code, Version 3 (January 11, 2013), updated with new priors from the April 2013 *ECP Guidance* to predict annual eagle fatality from the survey data. The model produces a mean estimate of fatality (i.e., mean among many model iterations) and 50%, 80%, 90%, and 95% upper credible intervals around the estimate. The *ECP Guidance* recommends the use of the 80% upper credible interval for eagle take permits and eagle conservation planning, which is presented here. The Bayesian estimation was completed using statistical programming language R (v. 3.0.2).

The following data and assumptions were used to run the USFWS Collision Fatality Model (Table 7.1). The current facility is approximately 30 MW using 13 General Electric GE 2.3-116 turbines. A 57-m (187-foot) rotor radius and an annual average daylight per day throughout the year calculated by the model based on sunrise/sunset for the physical location of the project. SWCA initially ran the model which was presented in a draft to the USFWS, who upon their review suggested that SWCA underestimated the number of minutes of eagle use from the EMI and E & E reports. USWFS currently recommends using 2 eagle minutes per detection when flight minutes are not recorded. USFWS used flight heights presented in an earlier version of the ECP, although it was not clear where this data originated. The E & E report also failed to provide enough information to estimate eagle flight minutes. Consequently, they were not used when the

USFWS completed their own run of the model, which used three seasonal breakdowns; one considering each season individually, even though no surveys were conducted during summer, another using winter and "not winter", and one scenario using no seasonal breakdown. Seasons are defined as follows: Spring = 1 Mar-30 Jun, Summer = 1 Jul-30 Aug, Fall = 1 Sep-30 Nov, and Winter = 1 Dec-29 Feb. The data was standardized to a 30-minute survey period.

Table 7.1. Summary of the Model Input Data

Season	EMI Data # of 30 Minute Surveys (Eagle Minutes)	SWCA Data # of 30 Minute Surveys (Eagle Minutes)	All Data
Spring	108 (2)	42 (0)	150 (2)
Summer	0 (0)	0 (0)	0 (0)
Fall	108 (0)	70 (0)	178 (0)
Winter)	36 (6)	70 (0)	106 (6)
Total	252 (8)	182 (0)	434 (8)

Results of USFWS's run of the Collision Fatality Model for the three scenarios are presented in Table 7.2. USFWS has recommended the winter/not winter breakdown since no surveys were conducted during summer months, and without any input data, the model will use the priors only, resulting in a higher 80th quantile estimate for eagle fatalities during the summer, and consequently, annually (0.4277 GE annually). The winter/not winter scenario better reflects actual use by eagles, primarily in the winter, and allows surveys conducted in spring and fall to represent the summer months. The annual model assumes equal use throughout the year, which would not be accurate. The average annual fatality rate would be expected to be 0.099 (80th quantile from the winter/not winter scenario). The results mean that 80% of the time we would expect approximately one eagle fatality or fewer every 10 years. For a five-year permit, the eagle fatality estimate would be 0.495, rounded up to one eagle mortality.

Table 7.2. Results of the USFWS Collision Fatality Model

Variable	Winter	Not Winter	Total
Mean	0.046	0.024	0.070
Standard Deviation	0.037	0.023	0.043
CI 80	0.068	0.036	0.099

The histogram below produced by the USFWS Collision Fatality Model for the data displays these same results in another manner (Figure 7.1). The histogram displays the frequency of the results from the 100,000 model simulations, with estimated number of annual collisions on the x-axis and number of simulations with this result on the y-axis. Red bars represent 50%, 80%, 90%, and 95% upper credible limits moving from left to right. The black bar represents the mean.

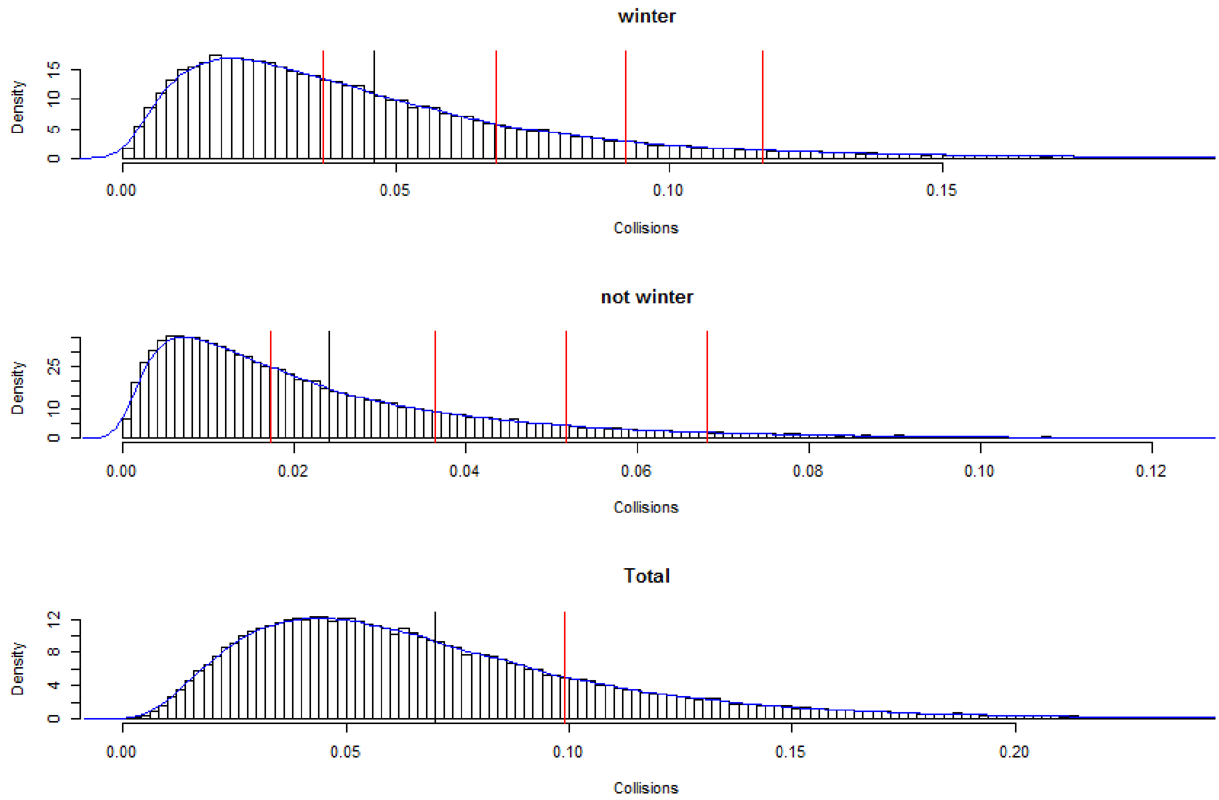


Figure 7.1. USFWS Collision Fatality Model histogram.

7.2 Other Eagle Risk Assessment

7.2.1 Disturbance/Displacement Assessment

Due to the lack of occupied nests within 50 km (31 miles) of the project area, it is unlikely that breeding disturbance would occur. There is little evidence in the literature to suggest that the presence of turbines and associated disturbance would dissuade eagles from using the site during the winter. This is particularly unlikely given the small number of turbines and the small acreage to be disturbed. The use of early versions of turbines, for example, at Altamont Pass that had a higher level of noise than modern turbines, did not appear to affect eagle use (National Wind Coordinating Collaborative 2010).

7.2.2 Assessment of Project-level Take

The project lies primarily within the Shortgrass Prairie Bird Conservation Region (BCR). Analysis by Millsap et al. (2013) suggested that golden eagle populations in this BCR have been relatively stable for the last 43 years. Each BCR is considered a golden eagle management unit to estimate the local area take benchmarks. Golden eagle population estimates in 2012 for BCR 18 was 1,444 (730-2401 95% confidence interval [C.I.]) as determined by the USFWS western wide golden eagle surveys (Millsap et al. 2016). These estimates are based on surveys conducted from

August 15 to September 15, timed when all juvenile eagles are expected to have fledged and the majority of golden eagles are unlikely to have initiated fall migrations.

The USFWS has identified take rates of between 1% and 5% of the estimated total eagle population size at the local area population scale (183.5-km [140-mile] buffer [based on median natal dispersal distance] surrounding the project for golden eagles) as significant, with 5% being at the upper end of what might be appropriate under the BGEPA preservation standard, regardless of whether compensatory mitigation is used to offset mortality. The 2013 *ECP Guidance* (USFWS 2013) recommends calculating the local area 5% benchmark as follows:

(Local-area * Regional Eagle Density) * 0.05

The 225-km (140-mile) radius around the project footprint encompasses 164,036 km^2 (63,334 square miles) Figure 7.1). The area overlaps two states, New Mexico and Texas and four BCRs: the Shortgrass Prairie (102,117 km^2 [39,428 square miles]), Chihuahuan Desert (43,496 km^2 [16,794 square miles]), Southern Rockies/Colorado Plateau (11,121 km^2 [4,294 square miles]) and Central Mixed Grass Prairie (7,302 km^2 [2,819 square miles]). Based on suggestions from the USFWS, the analysis used only data from BCR 18, in which the project is located and which represents the majority of the expanded footprint.   The latest regional density estimates adapted from the *ECP Guidance* (USFWS 2013) for resident golden eagles for the Shortgrass Prairie is 0.0028 eagle/km^2.

The estimated local area population size for the project is approximately 565 golden eagles. Based on this analysis, the local area 5% benchmark would be 28 golden eagles annually. An annual mortality rate of 0.099 or one golden eagle per 10 years comprises less than 0.001% of the total estimated local area population and 0.003% of the local area 5% benchmark for annual golden eagle mortality. Since no local or regional mortality data were available, further refinement of this calculation may be required by the USWFS.

Figure 7.2. Map of the 225-km (140-mile) Radius around the Project Area with Bird Conservation Regions.

7.2.3 Assessment of Cumulative Impacts Due to Other Projects

"Cumulative effects" are defined as "the incremental environmental impact or effect of the proposed action, together with impacts of past, present, and reasonably foreseeable future actions" (50 CFR 22.3). The *ECP Guidance* (USFWS 2013) recommends that cumulative effects analyses be consistent with the principles of cumulative effects outlined by the Council on Environmental Quality (CEQ). The CEQ regulations (40 CFR 1508.7) define cumulative impacts as past projects that occurred within the past 5 years, current projects, and reasonably foreseeable future projects that are planned to occur within the next 20 years and that have an "official" application or other formal process in place that would define them as "reasonably foreseeable."

The 225-km (140-mile) project radius was compared to the current distribution of wind projects as provided by the American Wind Energy Association (AWEA 2016). Based on the most current information from AWEA, there are 11 other operating wind projects within this radius buffer that might contribute to eagle mortality. These wind projects total approximately 872 MW of wind power (Table 7.3).

Table 7.3. Active Wind Facilities Located within the 225-km (140-mile) Radius of the Project

Project	Location	Capacity (MW)
Wildcat	NM	27
Caprock	NM	80
Mesaland Community College	NM	1.5
New Mexico Wind	NM	204
Anderson Wind	NM	15
Brahms Wind	NM	20
Llano Estacado	NM	1
Roosevelt Wind	NM	250
Reese	TX	2
Stanton Wind	TX	120
Notrees	TX	152

Evaluating wind resource maps provides an indication as to the potential for further wind development within this radius. Wind resources in eastern New Mexico and western Texas assure potential for future development (AWEA 2016; National Renewable Energy Laboratory 2016). Additional projects are proposed in western Texas that would be in the analysis radius, including Mesquite Creek (200 MW), Stephens Ranch (211 MW), and Fiber Winds (80 MW). The likelihood of golden eagle mortality may be greater in Texas with the larger number of turbines and the presence of increased number of wintering golden eagles.

As part of the assessment of cumulative impacts to golden eagles at the local area population scale, USFWS Region 2 would review all available internal records on known eagle mortalities within the 225-km (140-mile) buffer. This review would consider eagle mortality records from other existing wind energy facilities, as well as all other sources of known mortality, such as electrocution, collisions, shootings, poisonings, etc. This information, and the accompanying analysis, would be fully presented in the EA, which would accompany an application for an eagle incidental take permit. This information about known eagle mortality would then be used by USFWS Region 2 in the decision-making process about whether to issue a programmatic eagle take permit for the project and the level of take for golden eagles that could potentially be authorized.

Information regarding mortality at other wind projects, power lines, vehicles, and poisoning is not currently available. In addition, due to the confidentiality, ECPs and fatality estimates for these other projects are unknown. Completing a legitimate cumulative impacts assessment would require access to this information, and therefore any further analysis would need to be completed by the USFWS.

8 AVOIDANCE AND MINIMIZATION OF RISKS, COMPENSATORY MITIGATION, AND ADVANCED CONSERVATION PRACTICES

In addition to the measures listed below specifically for golden eagles, all measures described in the project BBCS (Hawkpoint Environmental Consulting 2019) for birds would have also been applied to benefit eagles.

8.1 Construction Best Management Practices

- The project will install tubular turbine towers to remove the ability of eagles to perch and therefore reduce risk of collision. External ladders and platforms will not be used on wind turbine generators to minimize perching and nesting opportunities for birds.
- Facility construction will occur on flat, level ground. Gravel aprons of at least 4.6 m (15 feet) around each turbine will be installed. These measures are intended to minimize opportunities for fossorial or burrowing mammals to increase prey abundance near turbines.
- No additional aboveground electrical power lines will be constructed, with the exception of the interconnection line extending 61 m (200 feet) from the substation.
- The one permanent meteorological tower will be a lattice type with guy wires.
- Revegetation, consistent with landowner agreements, will be limited to grass species in order to avoid the attraction of prey species.

8.2 Operational Phase

- Gravel aprons around the turbines will be maintained, keeping them clean and devoid of equipment or vegetation that might attract prey. Gravel will be placed in the apron foundation to discourage small mammals and reptiles from burrowing under or near turbine bases.
- Low speed limits (40 km [25 miles] per hour) will be enforced on the project site to avoid road kills that might produce carcasses that could attract eagles. Vehicle movement

associated with the project will be restricted to designated access and service roads and temporary construction areas.

- One guyed permanent meteorological tower will be kept on-site after commercial operations.
- Education programs will be implemented for workers (see the BBCS for details [Hawkpoint Environmental Consulting 2019]).
- Project personnel and all contractors will be instructed to remove garbage promptly at the end of each day to avoid creating attractive scavenging opportunities for birds.
- **Carcass Management Program.** Wildlife carcasses attract vultures, eagles, and other scavengers; therefore, the likelihood of collision increases when carcasses are present at a project site. AEM will work with the landowner and local and state agencies to ensure the regular removal of any dead medium-sized and large mammals from the area of the project. Through consultation with the NMDGF, alternate disposal areas for these carcasses should be located that are safer and that could benefit the local eagle population. This measure is aimed at preventing eagle attraction to the site, reducing the potential for collision and impact to the regional eagle population. To reduce the likelihood of attracting eagles within the project's footprint during the operations phases, project personnel will:
  - Look for animal carcasses while traveling through the site. All carcasses identified will be reported to the site manager within 8 hours and removed from the site within 48 hours of notification.
  - Look for kettles of vultures, eagles, or other scavenger birds that are circling in one area. Any kettles observed will be reported to the site manager within 8 hours, and the area below the kettle will be searched for carcasses within 24 hours. Any carcass found will be removed from the site within 48 hours of identification.
- **Wildlife Incident Reporting and Handling System**. As described in the BBCS, following the completion of the initial 2-year post-construction monitoring, AEM will implement an internal monitoring program that will be used by on-site project personnel to record eagle fatalities over the long-term duration of operation. During the initial 2-years of monitoring, personnel will be instructed not to collect dead animals without notifying a contact person. However, personnel will be trained to identify a golden eagle, should a fatality occur, and instructed to report it within 24 hours to contacts with the consultant and the USWFS.

8.2.1 COMPENSATORY MITIGATION COMMITMENT

The USFWS eagle take permit rule imposes a standard of no net loss to the breeding population. To achieve no net loss, a mitigation action can either reduce a current ongoing form of mortality (i.e., electrocutions from power poles) or it can increase carrying capacity, allowing the eagle population to increase. In either case, the mitigation action must be equal to or greater than the modeled mortality occurring from the project. These mitigation actions are considered compensatory mitigation. If a take permit is desired, compensatory mitigation must be completed prior to operations, because the project must meet the statutory eagle preservation standard before the USFWS can issue a permit (USFWS 2013).

Retrofits are also an effective and quantifiable compensatory mitigation measure and are still considered the most appropriate current option available to offset any fatalities that may occur as a result of operation of wind projects (USFWS 2016). The USFWS recently provided resource equivalency analysis (REA) models for calculating appropriate golden eagle and bald eagle compensatory mitigation values for power pole retrofits (USFWS 2013). The REAs for power pole retrofits use currently available information on golden and bald eagle life history inputs, effectiveness of retrofitting lethal electric poles, and an estimated annual take to develop a framework for power pole retrofits as compensatory mitigation for golden and bald eagle fatalities. The REA is used to determine the amount of compensatory mitigation needed by comparing eagle take (debit) with mitigation benefits (credits). For purposes of this ECP, the REA process outlined in Appendix G of the *ECP Guidance* (USFWS 2013) was used. For simplicity, the annual estimated take of golden eagles species as 0.06 per year (80% C.I. of highest estimate from Table 8.1 7.2) is used and rounded up to an overestimate of one golden eagle take over 5 years for subsequent calculations. It is assumed that should a golden eagle fatality not occur during the first 5 years, then the mitigation will roll over to cover additional years. The following inputs (Table 8.1) were used to develop the REA.

Table 8.1. Input for Developing Resource Equivalency Analysis

Parameter	Golden Eagle REA Input
Start year of permit	2017
Commercial operation	2017
Start year of mitigation	2017
Start year of take	2017
Start year of eagle reproduction	2018
Annual take estimate	1*
Length of permit review period	5 years
Average maximum lifespan	30 years
Age distribution of birds killed at wind facilities	Age 0–1 = 20% Age 1–4 = 35% Age 4–30 = 45%
Age start reproducing	Age 5 (age class 5–6)
Expected years of reproduction	25 years
% of adult females that reproduce annually	80%
Productivity	0.61
Year 0–1 survival	61%
Year 1–2 survival	79%
Year 2–3 survival	79%
Year 3–4 survival	79%
Year 4+ survival	91%
Relative productivity of mitigation option	0.0036 eagle electrocutions/pole/year
Discount rate (base year for discounting)	3% (2015)
Years of avoided loss from retrofitted poles	30 (assumes a 30-year maintenance agreement)

* Estimated mean annual mortality described in Section 7.1 rounded to 1 eagle fatality over a 5-year period.

AEM provided compensatory mitigation in communication with the USFWS to offset anticipated eagle take for the project, based on the REA results presented below. The following assumptions were included in the analyses: 1) the power pole retrofits would occur prior to taking golden eagles, 2) the project life is 30 years, and 3) the life of the retrofits is 30 years and/or the retrofits will be maintained for 30 years. Under these assumptions, the REA analysis under a 5-year permit scenario (keeping all other assumptions consistent), indicates that 65 poles would need to be retrofitted for the anticipated level of golden eagle take over the 5-year period. Since EMU take limits must be offset by compensatory mitigation at a 1.2 to 1 ratio, 78 retrofits would be needed to offset an eagle take.

Retrofits were completed in 2017 in coordination with Lea County Electric Cooperative, who was compensated for retrofitting poles. Methodology for electric pole modifications adhered to recommendations in EDM (2015) and in consultation with the USFWS.

If observed take is less than mitigated take after a 5-year review period, the excess take will be credited to the project. If take is higher, increased mitigation will be required by the USFWS. In either case, compensatory mitigation for the subsequent 5-year period would be re-evaluated based on actual results as compared with permitted levels of take (Table 8.2).

Table 8.2. Compensatory Mitigation Owed without Foregone Reproduction for the First 5-year Take Permit Review Period (assuming 30 Years of Avoided Loss from Retrofitted Poles)

Calculation	Golden Eagle	Description
Total debit	28.19	PV bird-years
÷ Relative productivity of lethal electric pole retrofitting	0.44	Avoided loss of PV bird-years/pole
= Credit owed for 5 years	**78**	**Poles to be retrofitted to achieve no net loss of eagles in first 5 years (65 poles adjusted for a 1.2 to 1 ratio).**

8.2.2 Experimental Advanced Conservation Practices

No advanced conservation practices are recommended at this time since there is substantial uncertainty surrounding both the risk of wind energy projects to eagles and ways to minimize that risk. To date, the development of advanced conservation practices has been limited by the lack of scientific validation. The low risk of the project to eagles based on the mortality estimate calculated for the project using the USFWS Collision Fatality Model does not warrant the implementation of any advanced conservation practices.

8.2.3 Adaptive Management Process

AEM will discuss with the USFWS the need for mitigation or experimental conservation measures if it is determined that impacts to eagles are higher than anticipated. An eagle take would prompt the revision of this document to address an adaptive management process that might result in the implementation of additional conservation measures or additional compensatory mitigation. Specific adaptive management measures may be incorporated into a future ITP.

9 CALIBRATION AND UPDATING OF FATALITY PREDICTION AND CONTINUED RISK ASSESSMENT (*ECP GUIDANCE STAGE 5*)

The observations made during post-construction monitoring using valid protocol would be reported to the USFWS, which would respond with appropriate management decisions depending on the results of the monitoring program.

9.1 TIER-4 POST-CONSTRUCTION MONITORING

A post-construction monitoring program for an initial 2 years, with the second year focused on the September–March period, was implemented at the project site. The intent of this monitoring program was to ensure that the turbines at the site are appropriately inspected for possible eagle fatalities or other impacts to eagles.

The initial post-construction monitoring was used to estimate the actual level of fatality and completed concurrently for birds and bats (see Hawkpoint Environmental Consulting 2018), with the methodology described below.

9.2 CARCASS SEARCHES

Surveys for avian and bat fatalities were initiated following commencement of project operations and continued for a full year (October 2017 to September 2018) to evaluate fatality levels from operation of the project. A second year September 2018 through March 2019 focused on sensitive species that only migrate or winter in the project area, such as golden eagles. Following the survey period, AEM will implement an internal monitoring program conducted by on-site workers to track fatalities for the rest of the life of the project (see Section 9.6).

Based on recent recommendations by the NWCC and American Wind Wildlife Institute, and due to the possible presence of large birds such as eagles, survey plots of 120 × 120 m (394 × 394 feet), centered on the wind turbine mast were used. All 13 turbines were surveyed monthly using transects spaced at 10-m (33-foot) intervals.

Data collected for each carcass included species, age, sex, estimated time since death, condition, type of injury, cover type, global positioning system (GPS) coordinates, distance to nearest wind turbine generator location, distance to nearest road, and distance to nearest structure. In the field, surveyors recorded wind speed, direction, temperature, sky conditions, precipitation events, and visibility at time of survey. All observed carcasses were photo-documented and identified to the lowest taxonomic level possible using photographs, field notes, and relevant scientific references.

9.3 SEARCHER EFFICIENCY TRIALS

Searcher efficiency studies were conducted to quantify searcher bias. The results of these studies were used to develop correction factors to estimate adjusted fatalities for the project and for each surveyed turbine, as appropriate as described by Huso (2011).

Searcher efficiency rates were expressed as the proportion of study carcasses that are detected by searchers in the searcher efficiency studies. These rates were grouped by carcass size and season for the adjusted fatality estimate.

Separate searcher efficiency rates were determined for the following three categories:

- Bats
- Large birds, defined here as
  - raptors (Falconiformes [diurnal birds of prey] and vultures);
  - waterfowl (Anseriformes, or ducks, geese, and swans); and
  - water birds (bitterns, herons, egrets, ibises, and cranes)
- Small birds (non-large bird species, primarily passerines)

Searcher efficiency studies were completed spring/summer and winter for the first year and in winter for the second year to account for different field conditions (e.g., denser spring/summer vegetation vs, sparser winter coverage) that may affect the ability of the surveyors to locate carcasses. However, the range conditions were relatively stable due to the grazing pressure, providing consistently good visibility for large bird carcasses.

Carcasses of species that approximate the size of each species in these categories were used for searcher efficiency studies. Mouse carcasses were used to represent bats, quail and similar sized bird carcasses were used to represent small birds, and chickens used to represent large birds (Erickson et al. 2000) Carcasses were distributed throughout the survey plots in locations unknown to the searchers (see Hawkpoint Environmental Consulting 2018).

Prior to initiating the searcher efficiency study, carcass locations were randomly generated but constrained, so that no more than three carcasses for a specific size group were located at any one turbine at a time to avoid predator swamping. A senior biologist who is not participating in the searcher efficiency studies planted carcasses at these predetermined turbines. The position and location were recorded for later comparison with the carcasses recorded by the surveying biologist. The biologist recorded the location of each carcass with a GPS unit, as well as ground cover type, vegetation, turbine number, date, and time. The percentage of planted mice, quail, and chickens located by surveyors were used to generate a correction factor (by turbine as appropriate) to estimate the actual number of bats or birds killed, based on the number of observed fatalities

Searcher efficiency rates were expressed as the proportion of study carcasses that are detected by searchers in the searcher efficiency studies. These rates were grouped by carcass size and season for the adjusted fatality estimate. No stratification by vegetation cover type was attempted, as the adjusted fatality estimate analysis only allows for one to two covariates (i.e., season and/or carcass size) and vegetation cover type is similar throughout the site (i.e., limited by sample size). In order to have an adequate sample size, at least 10 carcasses per stratum (i.e., bats, large birds, small birds) per season were used.

9.4 Carcass Removal Studies

The objectives of the carcass removal studies were to document the length of time carcasses remain in the surveyed area and are available to be found by searchers, and to determine the appropriate frequency of carcass searches for turbine-associated fatalities within the search plots. Carcass removal studies were completed for the same two seasons and concurrently with the searcher efficiency studies described above. Different seasonal rates for carcass removal were necessary to address changes in scavenging throughout the season, as well as over time, because scavengers adapt to novel food sources.

Carcasses were placed as described for searcher efficiency studies and checked on days 1–4, 7, 14, and 28 following placement or until they are all removed. Separate carcass removal rates were determined for bats, small birds (passerines), and large birds (raptors). All animals used in the carcass removal studies were handled with disposable nitrile gloves or an inverted plastic bag to avoid leaving a scent on the carcasses and interfering with the scavenger removal study (Arnett et al. 2009).

The mean carcass removal rate was derived from the carcass removal studies and used to adjust the search interval. Estimates of the probability that a carcass was not removed in the time between surveys and therefore was available to be found by searchers was used to adjust carcass counts for removal bias (Huso 2011; Huso et al. 2012).

9.5 Adjusted Fatality Estimates

Unadjusted (observed) fatalities (i.e., raw carcass counts) and adjusted fatality estimates (raw carcass count data adjusted for imperfect detectability) were presented in the post-construction monitoring report (Hawkpoint Environmental Consulting 2018) Adjusted fatality estimates were based on observed carcasses found during formal carcass searches, the probability that a searcher will miss a carcass (searcher efficiency correction factor), the probability that a carcass will be removed before a searcher can locate it (carcass persistence correction factor), and the proportion of turbines searched to the total number of turbines at the facility.

9.6 Worker Education and Search Program

As part of the BBCS completion and post-construction monitoring implementation, a worker education awareness program (WEAP) will be conducted for those employed at the project facility. This includes a program to be implemented for the life of the project beginning the first two years of post-construction monitoring studies. The program would accomplish the following:

- Provide a means of recording and collecting information on incidental avian and wildlife species found dead or injured within the project area by on-site project personnel.
- Produce a set of standardized instructions for on-site project personnel to follow in response to wildlife incidents in the project vicinity.
- Keep on-site project personnel mindful of wildlife interactions.

Consultants will brief all contractors, project operations staff, and other personnel who would be on-site on a regular basis through the WEAP. This training, which can be repeated as necessary throughout the project's operational period, teaches on-site staff how to identify bird and bat species that may occur in the project area, record observations of these species in a standardized format, including photo documentation, and take appropriate steps when downed birds and bats are encountered.

In addition to formal searches, a worker search program (WSP) would be developed and implemented for the lifetime of the facility. The Worker Education Awareness Program will provide specific direction to on-site operations staff on how to look for and record any avian fatalities. Turbines will be searched by operations staff on a regular basis, with every turbine being visited at least once each month. Operations staff will search the cleared area under turbines by walking a loop around the turbine approximately half way between the turbine and the edge of the cleared area. At each cardinal direction the worker will stop and scan the ground out as far as possible, looking for dead birds.

If a dead or injured bird is found at the facility by on-site personnel, the on-site manager will be notified immediately. The on-site manager will contact the Facility Project Manager, who will in turn notify the USFWS (an ESA-listed species or an eagle will be reported within 24 hours, and other migratory bird species will be reported within 10 days).

- The animal will not be moved or removed by any individual who does not have the appropriate permits.
- The location will be marked using GPS and photos taken.
- Permits are required to handle wildlife. The on-site manager will coordinate with the USFWS to arrange transportation and treatment of an injured threatened or endangered species or eagle. Animals that are approved for removal/relocation will be taken to a local USFWS- approved rehabilitation center or disposed of as recommended by USFWS. Non-eagle carcasses, and parts, would be legally distributed via licensed repositories such as University of New Mexico.

10 POST-CONSTRUCTION CONTINGENCY PLAN

Using the Bayesian model, it is estimated that golden eagle fatalities associated with the Sterling Wind Energy Facility would total 1 eagle in the first 5-year period based on the predicted annual fatality rounded-up. Compensatory mitigation has been applied for that projected take (see Section 8.2) to maintain no-net-loss of golden eagles by mitigating for the loss before it occurs.

Attainment of no-net-loss through mitigation is intended to offset golden eagle take beyond the initial estimate, should additional take occur. The initial golden eagle fatality estimate is 1 individual every 5 years and the mitigation cap represents a maximum cost relative to a conservative estimate of 1 additional eagle in a 5-year period. Based on pole retrofitting amounts of $500.00 per pole or transformer retrofit estimated from Lea County Electric Cooperative labor and materials, $32,500 would be needed to retrofit enough poles to offset one additional eagle fatality. Therefore, a total cost cap of $32,500 would be applied for a 5-year period. This cost cap would be reapplied each 5-year period.

11 PERMITS

A consultant acted as the agent in conducting the post-construction avian fatality monitoring on behalf of AEM. A directive from Washington, D.C., in March 2012 advised USFWS regional offices that applications for special purpose permits, including salvage permits for utilities, must originate from the owner or operator of the wind facility (Katie Wade Matthews, personal communication, January 23, 2014). AEM chose not to request a USFWS Special Purpose Utility permit (50 CFR 21.27). Consequently, all carcasses were marked and left in the field.

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APPENDIX A.
MINUTES FROM THE APRIL 16, 2011 MEETING

MINUTES OF MEETING

Issued by :	Erin Wiedower	**Date**	April 19, 2011
Email:	wiedower@akuoenergy.com	**Location**	USFWS Office, Albuquerque
Telephone :	1-312-291-4647	**Reference**	**MoM_AKUS_USFWS 110419**

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USFWS RECOMMENDATION	AKUO RESPONSE / ACTION
INTRODUCTION	
- The purpose of the meeting was for Akuo to reinitiate USFWS consultation regarding the proposed Sterling Wind Project, and for both teams from Akuo and USFWS to discuss the status, scope, and next steps of the ongoing environmental assessments for the project. - Have both teams introduce their respective members.	
STERLING WIND PROJECT - LEA COUNTY, NM	
• **Materials provided to USFWS one week prior to the meeting:** - Introductory project description letter, including a threatened and endangered species assessment table - Indicative site layout map - Fatal Flaw Analysis - Avian Baseline Survey report - Indicative turbine typical	
• **Environmental assessment status of the project:** - Comprehensive Fatal Flaw Analysis completed in February 2008. Included a site visit conducted on January 24 2008. - Avian Baseline Survey report completed in August 2010. Included multiple site visits conducted from March 2009 to February 2010 to incorporate all seasons.	
• **USFWS recommendations discussed:**	
- USFWS provided several references that could be used for regional bird presence assessments and migration pattern information including: USFWS Birds of Conservation Concern, USFWS Birds of Management Concern, USGS Breeding Bird Survey, and Christmas Bird Count data.	Akuo will research these references and apply the relevant species information as appropriate.
- A black-tailed prairie dog (*Cynomys ludovicianus*) survey (desktop) to determine the presence or absence of prairie dog towns on the site. It was explained that prairie dog presence may attract other species of concern, such as raptor species, to the project site if present. James (Jim) Stuart at the New Mexico Department of Game and Fish was recommended to assist with Akuo's desktop determination of prairie dog presence at the site.	Akuo contacted Jim Stuart as recommended on May 3, 2011. An email response regarding known prairie dog town locations was received on May 6, 2011. This email was forwarded to the USFWS representatives and Rachel Jankowitz at NMGF on that day.
- The spring and fall avian baseline surveys were considered adequate, but the wintering raptor survey needs further analysis considering the moderate risk USFWS determined for	Akuo will investigate the possibility of performing a more intensive wintering

USFWS RECOMMENDATION	AKUO RESPONSE / ACTION
raptors at the site. USFWS (Bob) recommended either more fixed point locations, or longer survey times at the fixed point locations, as part of this survey.	raptor survey this year.
- Verification of the inhabitants of the large nests that were observed on-site during the Fatal Flaw Analysis.	Akuo will investigate the possibility of conducting this survey on-site within the appropriate nesting time window this year.
- With respect to raptors and the lesser prairie chicken (*Tympanuchus pallidicinctus*), place as many (preferably all) transmission lines underground. For transmission lines that are placed aboveground, it was recommended that the Avian Power Line Interaction Committee Suggested Practices be followed during design and construction.	In the current layout, all transmission lines will be buried with the exception of an estimate 30 feet to connect the substation to the existing aboveground electric transmission line. For this small portion, Akuo will consider the suggested practices provided by the Avian Power Line Interaction Committee.
- Although there is no preferred riparian or forested habitat on the site to support bat species, USFWS recommended that bat acoustic monitoring technology be installed at the existing meteorological tower closest to the project layout in order to determine what, if any, bat species may be utilizing the project area.	Akuo will investigate the possibility of conducting bat acoustic monitoring during the summer and fall migration periods of this year.
- Akuo will email USFWS information regarding the meteorological towers located on-site.	Akuo emailed the meteorological tower information to the USFWS representatives on April 21, 2011.
- USFWS recommended that Akuo develop a project-specific Avian and Bat Protection Plan (ABPP), that USFWS will assist with and approve prior to project construction.	Upon the results of the avian and bat surveys, and if kuo still intends to build the project, Akuo will proactively draft a project-specific ABPP, with USFWS guidance.
• **Next steps:** - Akuo will seriously and proactively consider these USFWS recommendations and investigate the possibility and best options for additional environmental assessment surveys going forward. Akuo is targeting to close the financing of the project by the end of 2011 and must ensure that all future steps discussed here are compatible with the progress, budget, and schedule of the project. - Akuo will work towards a draft ABPP, to be developed in coordination with USFWS. - Akuo suggests that another meeting be held between USFWS and Akuo representatives in the summer of 2011, to reassess project status.	

APPENDIX B.
SUMMARY OF THE APRIL 11, 2016 MEETING

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Minutes from the April 11, 2016 Meeting between Akuo Energy and USFWS

Attendees: Florian Chevrollier and Thomas Cote (Akuo Energy), Pete David (SWCA), Bob Murphy and Jennifer Davis (USFWS)

Akuo provided a summary of the project emphasizing the reduction in the size of the project from 22,000 acres to 5,000 acres. Construction is planned for 2017 with a Commercial Operation Date anticipated for September 2017. Pete David gave a brief overview of the avian surveys completed and distributed maps. Jennifer Davis provided updated maps from CHAT regarding the buffer ranges of active lesser prairie chicken (LPC) leks to the east of the project area. SWCA will update the BBCS. Bob Murphy raised concerns about snowy plover nesting at Ranger Lake a mile northwest of the turbines. It was suggested use of the lake by birds be addressed in the BBCS.

Results of the eagle fatality model were presented to Bob. Bob mentioned the Draft Environmental Impact Statement regarding the eagle rule would be released this summer. The region is looking at completing a programmatic Environmental Assessment to cover low risk projects. A model may be used to evaluate each project to determine whether it qualified. There was agreement by USFWS that the Sterling Wind project would likely qualify since it posed a low risk to eagles based on the reduced project size and small number of turbines. Bob stressed the Service's standard position that developers pursue an eagle take permit. A discussion followed regarding mitigation. Bob reiterated the need for a solid ECP that highlights avoidance and minimization, and proposes some mitigation. He suggested retrofitting a series of power poles that might be located in risky locations for eagles.

Jennifer mentioned the rangewide plan for LPC, which incorporates lands outside 1.25-mile buffer from leks that could be used as future lek sites.

SWCA presented an option for post-construction monitoring that would complete a full year with the second year focused on September to March, the period when the species of concern: pipit, longspur, long-billed curlew, ferruginois hawk, and golden eagle would be present. Pete will provide the DRAFT post-construction monitoring methods section to Bob who will review with the agency's multi-office eagle committee.

It was agreed the BBCS would be submitted to Jennifer and the ECP to Bob. Bob confirmed that the Service could provide Akuo with an acknowledgement letter, which would confirm receipt of documents and include some language regarding low-risk projects having lower priority for law enforcement.

APPENDIX C.
BASELINE AVIAN STUDIES FOR THE PROPOSED STERLING RANCH WIND FARM

Baseline Avian Studies for the Proposed Sterling Ranch Wind Farm
Lea County, Tatum, New Mexico

August 2010

Prepared For:
Energy
150 North Michigan Avenue, Ste. 2800
Chicago, Illinois 60601

Prepared By:
Ecosystem Management, Inc.
4004 Carlisle Blvd NE, Ste. C-1
Albuquerque, New Mexico 87107

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Figures

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1.0 Introduction

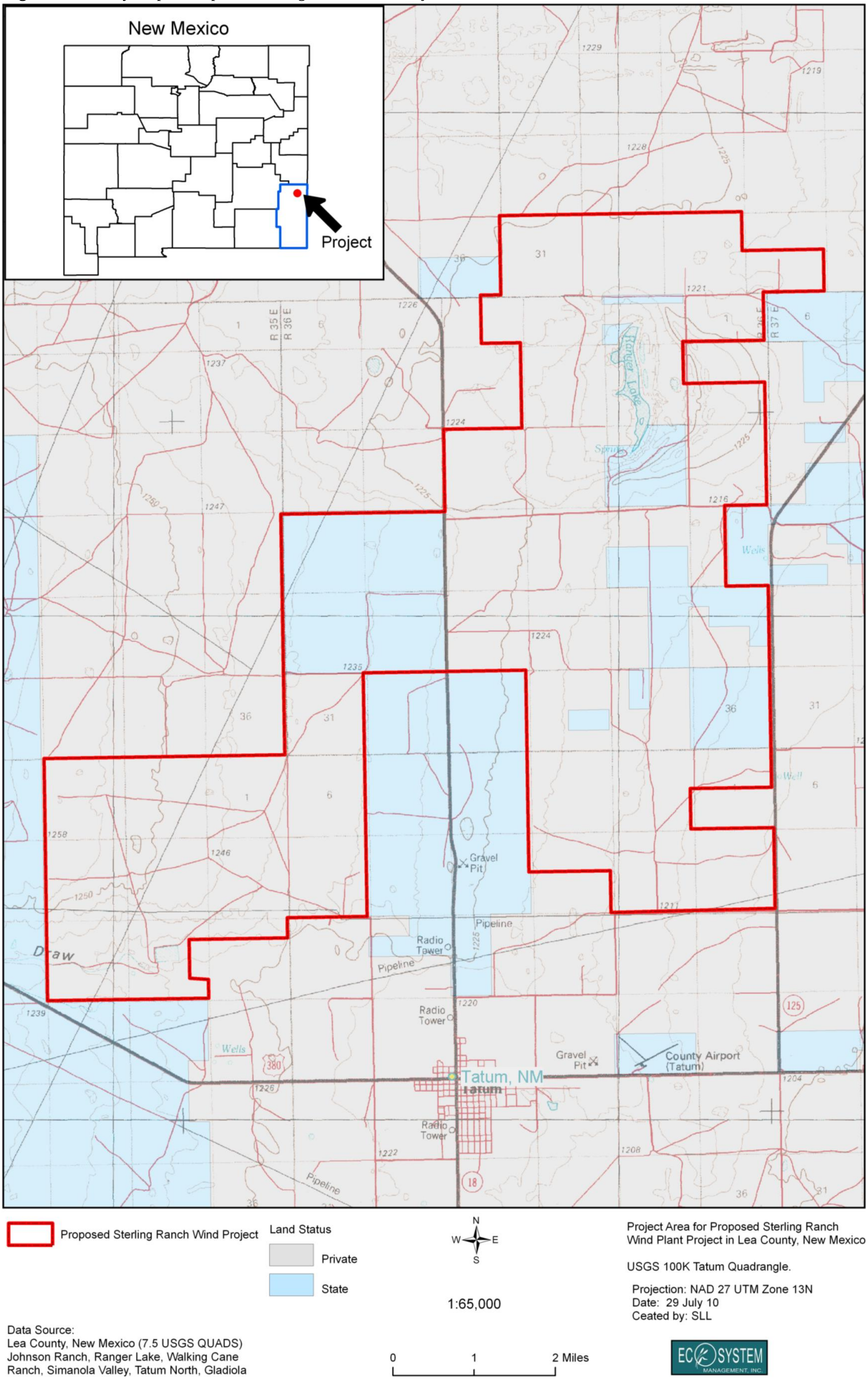
Akuo Energy is proposing to develop a potential wind power project in Lea County, New Mexico. The proposed Sterling Ranch Wind Project is 27,000 acres and located on private land approximately 1.5 miles north of Tatum, New Mexico (Figure 1). The exact location and size of the Sterling Ranch Wind Project depends on a number of factors including economics, transmission constraints, power purchase agreements, permitting, and results of the site surveys.

Prior to field surveys, wildlife issues were identified by the New Mexico Game and Fish Department (NMGFD) and the U.S. Fish and Wildlife Service (USFWS). These concerns included potential project impacts to avian and bat resources, specifically the potential for bird and bat mortality from collisions with turbines and associated transmission lines, and the probability of lesser prairie-chickens using the proposed Sterling Ranch Wind Project area. To address these concerns, the agencies requested that data be collected which may be used to describe these resources in the context of the proposed development, assist in addressing potential impacts from the development, and to the extent possible, assist in wind plant design and siting that minimizes risk to avian and bat resources. This report presents the results of the avian point counts and lesser prairie-chicken surveys conducted at the proposed Sterling Ranch Wind Project Area in March 2009 – February 2010.

A field study was initiated in March 2009 to address agency concerns and to provide site specific data on resources of concern. The objectives of the field study were the following:

- Document current avian use of Sterling Ranch that is useful in evaluating potential impacts from wind power development, and;
- Provide information on avian and lesser prairie-chicken use of Sterling Ranch that would help in designing a wind plant less likely to expose species to potential collisions with turbines.

Figure 1. Vicinity Map of Proposed Sterling Ranch Wind Project.



2.0 Study Area

The Sterling Ranch Project is located in the High Plains Arid Llano Estacado ecoregion of New Mexico. This ecoregion is characterized by flat, treeless, elevated plains surrounded by escarpments. Historically, the predominant vegetation type was shortgrass prairie with interspersed shrubland (Griffith et al. 2006). The dominant vegetation for the shortgrass priaire included blue, black and hairy grama, buffalograss, silver bluestem, sand dropseed, threeawn, Arizona cottontop, hairy tridens, muhly, bottlebrush squirreltail, and sand sagebrush. Currently, 80 – 90% of the land is tilled for agriculture with more rangeland to the west. The mean precipitation is approximately 14 to 16 inches annually and the mean high temperature in July is 92° (WRCC 2010).

The land within the project area is privately owned by the Sterling family and the primary land use is rangeland as grazing for cattle. The Sterling residence is located in the southeast portion of the project area to the north of Horton Road. The project area infrastructure includes local caliche roads and several access roads, an existing 69-kilovolt (kv) transmission line that borders the eastern boundary along State Highway 125, several windmills that provide water to cattle ponds, gates, and corrals. State Highway 206 runs north to south and bisects the middle of the project area. Vegetation in the project area remains shortgrass prairie with shrubland interspersed. The vegetative community occurring in the southern portion of Sterling Ranch is dominated by broom snakeweed with some short bunch grasses and cane cholla cactus interspersed. The topographic relief increases in the northern portion of the site and the vegetation community is composed of shortgrass prairie with shinnery oak interspersed. The vegetation within the central portion of the site is characterized by shortgrass prairie interspersed with dense patches of mesquite. Ranger Lake is the primary water feature within the Sterling Ranch, but did not have any surface water present.

3.0 Methods

The surveys consisted of fixed point surveys conducive to observing raptors and other large birds, and lesser prairie-chicken lek surveys.

3.1 Avian Fixed Point Surveys

The primary objective of the avian fixed point surveys was to estimate spatial and temporal use of the site by migrant raptors and other large birds. Point counts were conducted using the variable circular plot method (Reynolds et al. 1980). The point counts were selected to survey as much of the project area as possible. All birds observed were recorded, however the emphasis of the surveys were raptors and other large birds, which are thought to be more at risk for collisions with turbines. Avian use is considered an index to the density (number of individuals per unit area) of species using the wind plant site. Use was measured by counting birds observed within sample plots. Existing data from hawk watch sites in New Mexico were used to determine appropriate dates for maximizing observations of migrant raptors.

Twelve observation stations were located within the proposed wind plant site (Figure 2). Each station is an 800 meter radius circle centered on an observation point. Landmarks and

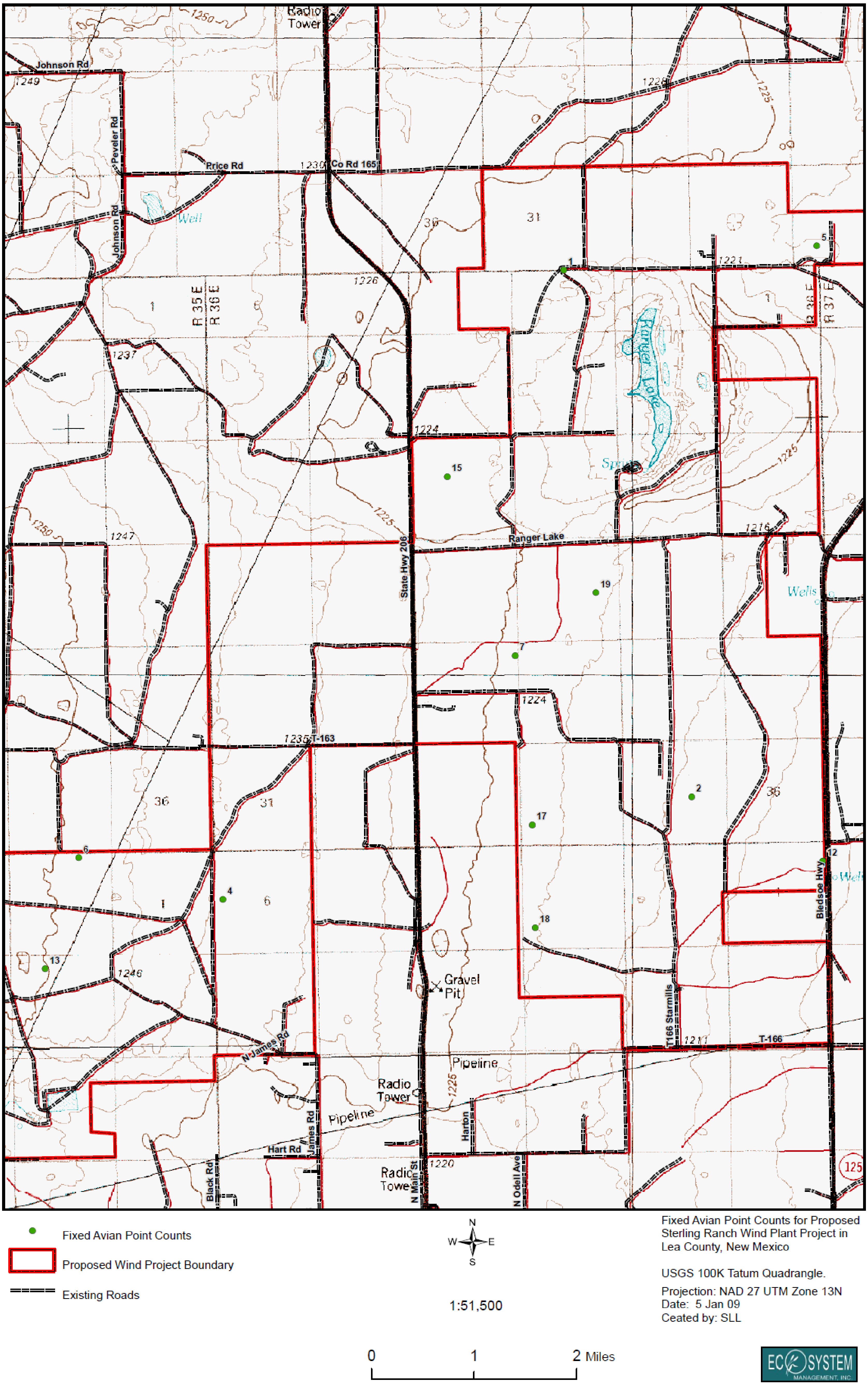


Figure 2 .Fixed Avian Point Counts for the Proposed Sterling Ranch Wind Site.

topographic features were used to identify the 800 meter boundary of each point when possible. Observations of birds beyond the 800 meter radius were recorded, but were not included in the analysis so that results were standardized among points as well as with similar wind plant studies.

All points were surveyed every two weeks from mid-March to July 2009(spring migration) and mid-September to mid-November 2009 (fall migration), and once a month in December 2009 and February 2010 for winter residents. Each station was visited twice during each sampling time; once during the morning (6 a.m. – 12 p.m.) and once during the afternoon (12 p.m. – 6 p.m.). Efforts were made to ensure each station was surveyed about the same number of times during each period of the day.

Each survey lasted for 30 minutes at each point. The observer allowed one minute before beginning the survey, to allow birds to acclimatize to their presence. During the survey, the observer made a 360 degree visual scan of the survey plot using binoculars. All birds observed were recorded on data sheets, and flight or movement patterns of raptors and other large birds were recorded on a map of the plot. The date, start and end time of the observation period, species or best possible identification, number of individuals, distance from plot center when first observed, behavior, and flight angle were recorded. Behavior categories included, but not limited to, were perched, soaring, flying, circling, hunting, and gliding. The distance from the plot center was recorded using a laser rangefinder and the flight angle was recorded using a clinometer. Weather information such as temperature, wind speed, and cloud cover was also recorded for each survey. Any comments or unusual behavior were also recorded.

3.2 Lesser prairie-chicken Lek Surveys

Lek surveys were conducted using the roadside survey protocol. Lek surveys were conducted along roads running north to south through suitable habitat in the proposed project area (Figure 3). The roads selected were approximately 1.8 miles apart, because leks can be heard from this distance. Each survey route was surveyed at least 3 times from mid-March to May (male lek peak) with each survey conducted 7–10 days apart. Surveys were conducted 30 – 45 minutes before sunrise to 2 hours after sunrise. The observer drove along the road route stopping every ½ mile to listen for gobbling lesser prairie-chickens. If a lek was located the observer recorded the approximate lek location using a GPS unit, then the observer walked towards the lek and recorded the exact lek location and the number of birds. In addition, the time, wind speed, temperature, and cloud cover conditions were recorded. The observer recorded the exact perimeter of the lek when the birds were absent using a GPS unit. Surveys were not conducted when wind speeds exceeded 10 mph. Photos were taken of the lek locations.

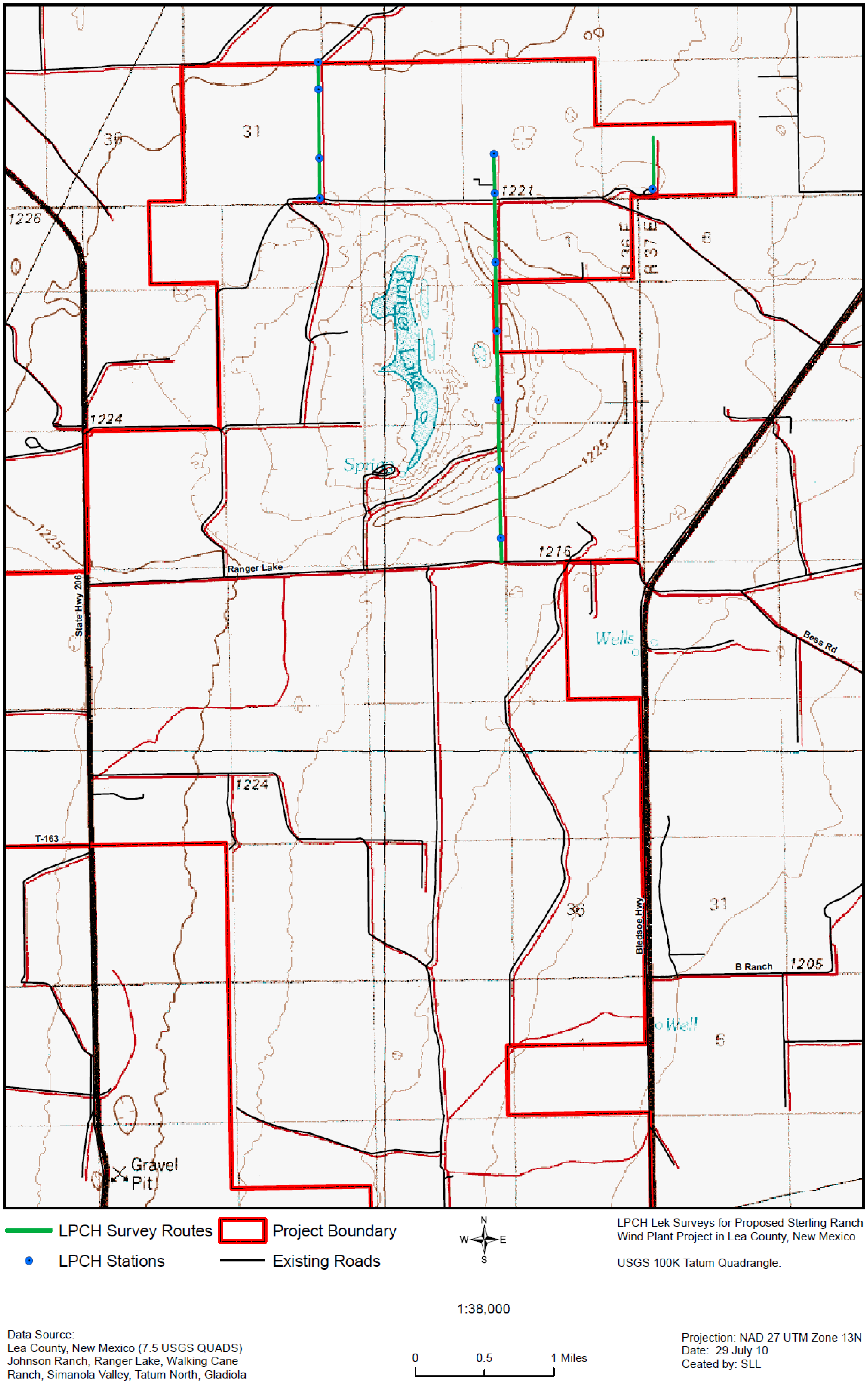


Figure 3. Lesser-Prairie Chicken (LPCH) Survey Routes for the Proposed Sterling Ranch Wind Site.

3.3 Data Analysis

3.3.1 Avian Surveys

Species lists were generated by season. The number of raptors and other species observed during each point count survey was standardized to a unit area and unit time searched. For example, if 2 raptors were seen during a survey at a point, then these data were standardized to 2 raptors/ 30-minute survey. Mean use is reported as the number of individuals observed per 30-minute survey. Mean use is tabulated for species and groups.

The frequency of occurrence by species is calculated as the percent of surveys where a particular species was observed. Species composition will be represented by the mean use for a species divided by the total use for all species and multiplied by 100 to provide percent composition. Frequency of occurrence and percent composition provide relative estimates of the avian diversity of the project area.

A relative index to collision exposure was calculated for bird species observed during the fixed point count surveys using the following formula: $R = A*P_f*P_t$

Where A = mean use of species (i) averaged across all surveys; P_f = proportion of all observations where species (i) activity was recorded as flying; and Pt = proportion of all flight height observations of species (i) within the rotor-swept height (RSH). The RSH height is 25 – 125 meters. This index does not account for differences in behavior besides flight characteristics (i.e., flight height, proportion of time spent flying).

4.0 Results

4.1 Avian Fixed Point Surveys

Surveys were conducted at 12 fixed point count stations located within the study area (Figure 2) approximately every two weeks from mid-March to July 2009 (spring migration) and mid-September to mid-November 2009 (fall migration), and once a month in December 2009 and February 2010 (winter residents). A total of 252 30-minute point count surveys were conducted.

A total of 43 avian species with 2,239 total observations in 843 different groups were observed during the fixed point count surveys (Table 1). Table 1 provides the raw numbers of observations, which are not standardized, but provide an overall list of birds observed. These counts may contain duplicate counts of the same individuals.

Raptors were the most common group observed with Swainson's hawks (*Buteo swainsoni*) as the most commonly observed raptor species (44% of all raptor observations). Raptors comprised 20% of all birds observed and 33% of all groups observed. Passerines were the most common bird observed with lark buntings (*Calamospiza melanocorys*) being the most common species. Passerines comprised 41% of all birds observed and 28% of all groups observed. Corvids (crows and ravens) comprised 23% of all birds observed and 33% of all groups observed. Shorebirds comprised 7% of all birds observed and 0.7% of all groups observed due to a large flock of long-billed curlews (*Numenius americanus*) observed during the fixed point counts.

Observations varied by season with spring having the most individuals and groups observed (Table 1). Fall had the most individual and groups observed for raptors. Observations for all individuals and groups declined in winter.

Table 1. Avian Species /Groups Observed During the Avian Fixed Point Count Surveys on the Study Area, March 2009 – February 2010.

Species/Group	Spring		Fall*		Winter	
	obs.	groups	obs.	groups	obs.	groups
Waterfowl						
Snow Goose	1	1	0	0	0	0
Unidentified ducks	11	1	0	0	0	0
Subtotal	12	2	0	0	0	0
Shorebirds						
American Avocet	1	1	0	0	0	0
Great Blue Heron	0	0	1	1	0	0
Long-Billed Curlew	0	0	164	4	0	0
Subtotal	1	1	165	5	0	0
Raptors						
American Kestrel	4	4	2	2	1	1
Golden Eagle	1	1	1	1	6	6
Ferruginous Hawk	1	1	4	4	12	11
Merlin	0	0	1	1	0	0
Northern Harrier	9	8	5	5	7	7
Prairie Falcon	0	0	2	2	0	0
Red-Tailed Hawk	3	3	5	3	5	5
Swainson’s Hawk	45	34	195	100	0	0
Unidentified Buteo	5	5	25	20	2	2
Unidentified Falcon	0	0	2	2	0	0
Turkey Vulture	12	9	191	64	0	0
Subtotal	80	65	433	204	33	32
Corvids						
American Crow	27	10	0	0	0	0
Chihuahuan Raven	84	46	0	0	11	2
Common Raven	267	151	24	11	49	29
Unidentified Raven	30	19	21	10	0	0
Subtotal	410	227	45	21	60	31
Upland Game Birds						
Scaled Quail	4	2	2	1	35	1
Subtotal	4	2	2	1	35	1
Doves						
Mourning Doves	4	1	0	0	0	0

Species/Group	Spring		Fall*		Winter	
	obs.	groups	obs.	groups	obs.	groups
Subtotal	4	1	0	0	0	0
Cuckoos						
Greater Roadrunner	1	1	0	0	0	0
Subtotal	1	1	0	0	0	0
Woodpeckers						
Downy Woodpecker	1	1	0	0	0	0
Ladder-backed Woodpecker	1	1	0	0	0	0
Red-Shafted Flicker	0	0	4	1	0	0
Subtotal	2	2	4	1	0	0
Passerines						
Barn Swallow	25	9	0	0	0	0
Brown-Headed Cowbird	0	0	25	1	0	0
Cassin Sparrow	2	1	0	0	0	0
Carolina Wren	4	3	0	0	0	0
Chipping Sparrow	4	3	0	0	0	0
Common Grackle	1	1	0	0	0	0
Eastern Meadowlark	0	0	0	0	9	8
Horned Lark	10	9	0	0	28	5
Lark Bunting	311	24	235	11	27	10
Lark Sparrow	33	15	0	0	0	0
Loggerhead Shrike	6	6	2	1	4	3
Northern Mockingbird	6	6	0	0	0	0
Red-Winged Blackbird	7	1	0	0	0	0
Say's Phoebe	7	5	0	0	0	0
Scissor-Tailed Flycatcher	8	7	5	1	0	0
Song Sparrow	0	0	1	1	0	0
Swainson's Thrush	0	0	2	1	0	0
Western Bluebird	0	0	20	1	0	0
Western Kingbird	15	11	0	0	0	0
Western Meadowlark	85	72	6	4	1	1
White-Crowned Sparrow	4	2	0	0	0	0
Unidentified Sparrow	18	8	10	1	0	0
Unidentified Warbler	2	1	0	0	0	0
Subtotal	548	184	306	22	69	27
Grand Total	**1062**	**487**	**980**	**265**	**197**	**91**

* Includes observations greater than 800 m from the center of the point count

4.1.1 Avian Use

To allow for comparisons to other studies, the number of raptors and other species observed during each point count survey was standardized to a unit area and unit time searched and species composition was calculated using only observations within 800 meters of the observation point. The point counts do not distinguish between individuals, but provide avian use of the study area. Abundance refers to mean use of the study area not absolute density or numbers of individuals.

The three most abundant species in the study area were lark buntings (2.27 detections/30 minute survey), common raven (*Corvus corax*) (1.35 detections/ 30 minute survey), and Swainson's hawks (0.97 detections/30 minute survey). Together these species comprised more than 56% of the total bird use observed during the fixed point counts. Passerines were the most abundant group observed with approximately 4 individuals observed during each survey (Table 2). The most abundant raptors observed were Swainson's hawk (0. 92 detections/30 minute survey), turkey vulture (*Cathartes aura*) (0.53 detections/30 minute survey), and Northern harrier (*Circus cyaneus*) (0.08 detections/30 minute survey) (Table 2).

The only species of waterfowl observed was an individual Snow goose (*Chen caerulescens*) during spring counts (Table 2). Shorebird use was highest in the fall (0.60/30 minute survey) due to two large flocks of long-billed curlews. Upland game bird use was the highest in winter (0.97/30 minute survey) due to a large covey of scaled quail (*Callipepla squamata*). Raptor use was highest in the fall (3.17/30 minute survey), and similar in spring (0.74/30 minute survey) and winter (0.92/30 minute survey) (Table 2). Corvid use was highest in spring (3.78/30 minute survey) and lowest in the fall (0.42/30 minute survey) (Table 2). Passerine use was highest in the spring (5.07/30 minute survey) and lowest in winter (1.92/30 minute survey) (Table 2).

The raptor species with the highest use in spring were Swainson's hawks (0.42/survey) and turkey vultures (0.11/30 minute survey) (Table 2). Corvids with the highest use were common ravens (2.47/30 minute survey). Passerines with the highest use were lark buntings (2.88/survey), western meadowlarks (0.79/30 minute survey), and lark sparrows (0.31/30 minute survey) (Table 2).

In fall, the raptor species with the highest use were Swainson's hawks (1.72/30 minute survey) and turkey vultures (1.13/30 minute survey) (Table 2). Corvids with the highest use were common ravens (0.22/30 minute survey). Passerines with the highest use were lark buntings (2.18/30 minute survey), brown headed cowbird (0.23/30 minute survey), and western bluebirds (0.19/30 minute survey) (Table 2).

In winter, the raptor species with the highest use were Ferruginous hawk (0.33/30 minute survey), northern harrier (0.19/30 minute survey), golden eagle (0.17/30 minute survey), and red-tailed hawk (0.14/30 minute survey) (Table 2). Corvids with the highest use were common ravens (1.36/survey). Passerines with the highest use were horned larks (0.78/30 minute survey), and lark buntings (0.75/30 minute survey) (Table 2).

Table 2. Estimated Mean Use and Frequency for Species/Groups Observed Within 800 m of the Point During Avian Fixed Point Count Surveys on the Study Area, March 2009 – February 2010.

Species/Group	Spring		Fall		Winter		Overall	
	Mean Use	Freq (%)	Mean Use	Freq (%)	Mean Use	Freq (%)	Mean Use	Freq (%)
Waterfowl	**0.11**	**1.85**	**0**	**0**	**0**	**0**	**0.048**	**0.80**
Snow Goose	0.01	0.93	–	–	–	–	0.004	0.40
Unidentified ducks	0.10	0.93	–	–	–	–	0.044	0.40
Shorebirds	**0.01**	**0.93**	**0.60**	**2.78**	**0**	**0**	**0.262**	**1.59**
American Avocet	0.01	0.93	–	–	–	–	0.004	0.40
Great Blue Heron	–	–	0.01	0.93	–	–	0.004	0.40
Long-Billed Curlew	–	–	0.59	1.85	–	–	0.254	0.79
Raptors	**0.74**	**49.07**	**3.17**	**116.67**	**0.92**	**54.00**	**1.806**	**79.76**
American Kestrel	0.04	2.78	0.02	1.85	0.03	2.78	0.028	2.38
Golden Eagle	0.01	0.93	0.01	0.93	0.17	8.33	0.032	1.98
Ferruginous Hawk	0.01	0.93	0.04	2.78	0.33	19.44	0.067	4.37
Merlin	–	–	0.01	0.93	–	–	0.004	0.40
Northern Harrier	0.08	7.41	0.05	4.63	0.19	13.89	0.083	7.14
Prairie Falcon	–	–	0.02	1.85	–	–	0.008	0.79
Red-Tailed Hawk	0.03	2.78	0.03	1.85	0.14	4.00	0.044	3.57
Swainson's Hawk	0.42	25.93	1.72	57.41	–	–	0.917	35.71
Unidentified Buteo	0.05	4.63	0.13	11.11	0.06	5.56	0.083	7.54
Unidentified Falcon	–	–	0.02	1.85	–	–	0.008	0.79
Turkey Vulture	0.11	3.70	1.13	31.48	–	–	0.532	15.08
Corvids	**3.78**	**93.52**	**0.42**	**12.96**	**1.67**	**47.22**	**2.036**	**52.38**
American Crow	0.25	5.56	–	–	–	–	0.107	2.38
Chihuahuan Raven	0.78	16.67	–	–	0.31	5.56	0.377	7.94
Common Raven	2.47	60.19	0.22	7.41	1.36	41.67	1.349	34.92
Unidentified Raven	0.28	11.11	0.19	5.56	–	–	0.202	7.14
Upland Game Birds	**0.04**	**0.93**	**0.02**	**0.93**	**0.97**	**2.78**	**0.163**	**1.19**
Scaled Quail	0.04	0.93	0.02	0.93	0.97	2.78	0.163	1.19
Doves	**0.04**	**0.93**	**0**	**0**	**0**	**0**	**0.016**	**0.40**
Mourning Doves	0.04	0.93	–	–	–	–	0.016	0.40
Cuckoos	**0.01**	**0.93**	**0**	**0**	**0**	**0**	**0.004**	**0.40**
Greater Roadrunner	0.01	0.93	–	–	–	–	0.004	0.40
Woodpeckers	**0.02**	**1.85**	**0.04**	**0.93**	**0**	**0**	**0.024**	**1.20**
Downy Woodpecker	0.01	0.93	–	–	–	–	0.004	0.40

Species/Group	Spring		Fall		Winter		Overall	
	Mean Use	Freq (%)	Mean Use	Freq (%)	Mean Use	Freq (%)	Mean Use	Freq (%)
Ladder-backed Woodpecker	0.01	0.93	–	–	–	–	0.004	0.40
Red-Shafted Flicker	–	–	0.04	0.93	–	–	0.016	0.40
Passerines	**5.07**	**135.19**	**2.83**	**16.67**	**1.92**	**52.78**	**3.663**	**69.05**
Barn Swallow	0.23	6.48	–	–	–	–	0.099	2.78
Brown-Headed Cowbird	–	–	0.23	0.93	–	–	0.099	0.40
Cassin Sparrow	0.02	0.93	–	–	–	–	0.008	0.40
Carolina Wren	0.04	2.78	–	–	–	–	0.016	1.19
Chipping Sparrow	0.04	2.78	–	–	–	–	0.016	1.19
Common Grackle	0.01	0.93	–	–	–	–	0.004	0.40
Eastern Meadowlark	–	–	–	–	0.25	16.67	0.036	2.38
Horned Lark	0.09	6.48	–	–	0.78	8.33	0.151	3.97
Lark Bunting	2.88	17.59	2.18	6.48	0.75	16.67	2.274	12.70
Lark Sparrow	0.31	12.96	–	–	–	–	0.131	5.56
Loggerhead Shrike	0.06	3.70	0.02	0.93	0.11	8.33	0.048	2.78
Northern Mockingbird	0.06	5.56	–	–	–	–	0.024	2.38
Red-Winged Blackbird	0.06	0.93	–	–	–	–	0.028	0.40
Say's Phoebe	0.06	3.70	–	–	–	–	0.028	1.59
Scissor-Tailed Flycatcher	0.07	5.56	0.05	0.93	–	–	0.052	2.78
Song Sparrow	–	–	0.01	0.93	–	–	0.004	0.40
Swainson's Thrush	–	–	0.02	0.93	–	–	0.008	0.40
Western Bluebird	–	–	0.19	0.93	–	–	0.079	0.40
Western Kingbird	0.14	8.33	–	–	–	–	0.060	0.40
Western Meadowlark	0.79	46.30	0.06	3.70	0.03	2.78	0.365	21.83
White-Crowned Sparrow	0.04	1.85	–	–	–	–	0.016	0.79
Unidentified Sparrow	0.17	7.41	0.09	0.93	–	–	0.111	3.57
Unidentified Warbler	0.02	0.93	–	–	–	–	0.008	0.40
Total	**9.81**		**7.07**		**5.47**		**8.02**	

4.1.2 Frequency of Occurrence and Species Composition

Frequency of occurrence and species composition provide relative estimates of avian density of the study area. Based on frequency of occurrence two species were observed in over one- third of all surveys, Swainson's hawk (36%) and the common raven (35%). Swainson's hawk, common raven, and lark bunting made up approximately 57% of all bird use. Most species were observed in less than 5% of all surveys (Table 2). The most frequently observed raptor was

Swainson's hawk with 11.4% of total avian use (Table 3). Turkey vultures were observed approximately 15% of all surveys, and comprised 6.63% of all avian use. The common raven was observed approximately 35% of all surveys with 16.81% of all avian use (Table 3). In contrast lark bunting s were observed in approximately 13% of all surveys, but comprised 28.34% of all avian use (Table 3).

The three most abundant groups based on use were passerines, corvids, and raptors (Table 4). Passerine occurrence remained steady across the study period, and was lowest in winter (35.03%). Corvid occurrence was similar in spring and winter with a drop in fall (5.89%) (Table 4). Raptor occurrence peaked in fall and was low in the spring and winter survey periods (Table 4).

Table 3. Estimated Species Composition for Species/Groups Observed Within 800 m of the Point During Avian Fixed Point Count Surveys on the Study Area, March 2009 – February 2010.

Species/Group	Spring	Fall	Winter	Overall
	Species Comp (%)	Species Comp (%)	Species Comp (%)	Species Comp (%)
Waterfowl	**1.13**	**0**	**0**	**0.59**
Snow Goose	0.09	–	–	0.05
Unidentified ducks	1.04	–	–	0.54
Shorebirds	**0.09**	**8.51**	**0**	**3.26**
American Avocet	0.09	–	–	0.05
Great Blue Heron	–	0.13	–	0.05
Long-Billed Curlew	–	8.38	–	3.17
Raptors	**7.55**	**44.79**	**16.75**	**22.50**
American Kestrel	0.38	0.26	0.51	0.35
Golden Eagle	0.09	0.13	3.05	0.40
Ferruginous Hawk	0.09	0.52	6.09	0.84
Merlin	–	0.13	–	0.05
Northern Harrier	0.85	0.65	3.55	1.04
Prairie Falcon	–	0.26	–	0.10
Red-Tailed Hawk	0.28	0.39	2.54	0.54
Swainson's Hawk	4.25	24.36	–	11.42
Unidentified Buteo	0.47	1.83	1.02	1.04
Unidentified Falcon	–	0.26	–	0.10
Turkey Vulture	1.13	15.98	–	6.63
Corvids	**38.42**	**5.89**	**30.46**	**25.37**
American Crow	2.54	–	–	1.34
Chihuahuan Raven	7.91	–	5.58	4.70
Common Raven	25.14	3.14	24.87	16.81

Species/Group	Spring	Fall	Winter	Overall
	Species Comp (%)	Species Comp (%)	Species Comp (%)	Species Comp (%)
Unidentified Raven	2.82	2.75	–	2.52
Upland Game Birds	**0.38**	**0.26**	**17.77**	**2.03**
Scaled Quail	0.38	0.26	17.77	2.03
Doves	**0.38**	**0**	**0**	**0.20**
Mourning Doves	0.38	–	–	0.20
Cuckoos	**0.09**	**0**	**0**	**0.05**
Greater Roadrunner	0.09	–	–	0.05
Woodpeckers	**0.19**	**0.52**	**0**	**0.30**
Downy Woodpecker	0.09	–	–	0.05
Ladder-backed Woodpecker	0.09	–	–	0.05
Red-Shafted Flicker	–	0.52	–	0.20
Passerines	**51.60**	**40.08**	**35.03**	**45.65**
Barn Swallow	2.35	–	–	1.24
Brown-Headed Cowbird	–	3.27	–	1.24
Cassin Sparrow	0.19	–	–	0.10
Carolina Wren	0.38	–	–	0.20
Chipping Sparrow	0.38	–	–	0.20
Common Grackle	0.09	–	–	0.05
Eastern Meadowlark	–	–	4.57	0.45
Horned Lark	0.94	–	14.21	1.88
Lark Bunting	29.29	30.78	13.71	28.34
Lark Sparrow	3.11	–	–	1.63
Loggerhead Shrike	0.56	0.26	2.03	0.59
Northern Mockingbird	0.56	–	–	0.30
Red-Winged Blackbird	0.66	–	–	0.35
Say’s Phoebe	0.66	–	–	0.35
Scissor-Tailed Flycatcher	0.75	0.65	–	0.64
Song Sparrow	–	0.13	–	0.05
Swainson’s Thrush	–	0.26	–	0.10
Western Bluebird	–	2.62	–	0.99
Western Kingbird	1.41	–	–	0.74
Western Meadowlark	8.00	0.79	0.51	4.55
White-Crowned Sparrow	0.38	–	–	0.20
Unidentified Sparrow	1.69	1.31	–	1.38
Unidentified Warbler	0.19	–	–	0.10

4.1.3 Flight Height Characteristics

The proportion of observations of bird species flying within the rotor swept area provides a rough estimate for the likelihood of that species to fly within the area occupied by the turbine rotors (Table 4). Since the turbine sizes have yet to be determined, the "zone of risk" used included the area from 25 m above ground level (AGL) to 125 m AGL, which is the union of rotor swept areas for smaller (e.g., 900 kw) and larger (e.g., 2 MW) turbines being constructed. Most passerine birds were typically observed flying below 25 meters with the exception of horned larks. The larger birds (i.e., raptors, corvids, shorebirds, waterfowl) tend to fly higher than 25 meters within the primary zone of influence for turbine blades for most newer generation turbines. As a group, 38% of corvids were observed within the zone of risk followed by raptors (31%), whereas passerines were not likely to be observed in the zone of risk (5%). Shorebirds and waterfowl had the highest percent of individuals observed within the zone of risk, however only 5 groups were observed.

Table 4. Flight Height Characteristics by Species Observed During Avian Fixed Point Count Surveys at the Sterling Ranch Site, March 2009 – February 2010.

Species/Group	**No. Observed Flying**		**Birds Flying (%)**	**Relation to Rotor Swept Area**		
	Individual	Flock		**below**	**within**	**above**
Waterfowl						
Snow Goose	1	1	100	0	100	0
Unidentified ducks	0	0	0	–	–	–
Shorebirds						
American Avocet	1	1	100	0	0	100
Great Blue Heron	1	1	100	0	100	0
Long-Billed Curlew	64	2	100	0	100	0
Raptors						
American Kestrel	6	6	85.71	33.33	66.67	0
Golden Eagle	6	6	75.00	16.67	16.67	66.67
Ferruginous Hawk	12	11	70.59	25.00	25.00	50.00
Merlin	1	1	100	100	0	0
Northern Harrier	19	18	90.48	68.42	15.79	15.79
Prairie Falcon	2	2	100	50.00	50.00	0
Red-Tailed Hawk	7	7	63.64	28.57	14.29	57.14
Swainson's Hawk	160	87	69.26	36.88	24.38	38.75
Unidentified Buteo	17	16	80.95	58.82	23.53	17.65
Unidentified Falcon	2	2	100	50.00	50.00	0
Turkey Vulture	134	63	100	48.51	41.04	10.45
Corvids						
American Crow	26	9	96.30	11.54	38.46	50.00

Species/Group	No. Observed Flying		Birds Flying (%)	Relation to Rotor Swept Area		
	Individual	Flock		below	within	above
Chihuahuan Raven	72	33	75.79	25.00	58.33	16.67
Common Raven	238	127	70.00	58.82	30.68	10.50
Unidentified Raven	30	17	58.82	40.00	43.33	16.67
Upland Game Birds						
Scaled Quail	35	1	85.37	100	0	0
Doves						
Mourning Doves	4	1	100	100	0	0
Cuckoos						
Greater Roadrunner	0	0	0	–	–	–
Woodpeckers						
Downy Woodpecker	1	1	100	100	0	0
Ladder-backed Woodpecker	0	0	0	–	–	–
Red-Shafted Flicker	0	0	0	–	–	–
Passerines						
Barn Swallow	24	8	96.00	33.33	12.50	54.17
Brown-Headed Cowbird				–	–	–
Cassin Sparrow	2	1	100	100	0	0
Carolina Wren	2	1	50.00	100	0	0
Chipping Sparrow	2	1	50.00	100	0	0
Common Grackle	1	1	100	100	0	0
Eastern Meadowlark	5	4	55.56	80.00	20.00	0
Horned Lark	32	8	84.21	37.50	40.63	21.88
Lark Bunting	450	31	78.53	99.56	0	0.44
Lark Sparrow	16	6	48.49	87.50	12.50	0
Loggerhead Shrike	2	2	16.67	50.00	50.00	0
Northern Mockingbird	1	1	16.67	100	0	0
Red-Winged Blackbird	7	1	100	0	100	0
Say's Phoebe	3	2	42.86	66.67	0	33.33
Scissor-Tailed Flycatcher	2	2	15.38	50.00	50.00	0
Song Sparrow	0	0	0	–	–	–
Swainson's Thrush	0	0	0	–	–	–
Western Bluebird	20	1	100	100	0	0
Western Kingbird	9	7	60.00	100	0	0
Western Meadowlark	18	14	19.57	83.33	16.67	0
White-Crowned Sparrow	2	1	50.00	100	0	0

Species/Group	No. Observed Flying		Birds Flying (%)	Relation to Rotor Swept Area		
	Individual	Flock		below	within	above
Unidentified Sparrow	24	8	85.71	100	0	0
Unidentified Warbler	2	1	100	100	0	0
ALL Birds	**1463**	**514**	**72.39**	**64.25**	**23.79**	**11.96**

Table 5. Percent of Avian Groups Observed Flying Below, Within, and Above the Rotor Swept Area of Turbines.

Groups	No. Observed Flying		Birds Flying (%)	Relation to Rotor Swept Area		
	Individual	Flock		Below	Within	Above
Waterfowl	1	1	8.33	0	100	0
Shorebirds	66	4	100	0	98.48	1.51
Raptors	366	219	80.44	42.90	30.87	26.23
Corvids	366	186	71.34	47.27	37.71	15.03
Passerines	624	101	67.61	91.35	4.97	3.69

4.1.4 Exposure Index

Exposure index provides a relative measure of the risk each species observed during the point count surveys has colliding with a turbine. This index is based on mean use of the study area by the species and the flight characteristics observed of the species. Common raven, long-billed curlew, and turkey vultures had the highest exposure indices (Table 6). Lark buntings were the most abundant species observed, but were all observed flying below the zone of risk, whereas the two large flocks of long-billed curlews were observed flying within the zone of risk. Raptor species with the highest exposure index were turkey vulture and Swainson's hawk.

Table 6. Mean Exposure Index by Species Observed During Avian Fixed Point Count Surveys at the Sterling Ranch Site, March 2009 – February 2010.

Species/Group	Mean Use	Birds Flying (%)	RSHA (%)	Exposure Index
Waterfowl				
Snow Goose	0.004	100	100	0.004
Unidentified ducks	0.044	0.000	N/A	N/A
Shorebirds				
American Avocet	0.004	100	0.000	0.000
Great Blue Heron	0.004	100	100	0.004
Long-Billed Curlew	0.254	100	100	0.254
Raptors				
American Kestrel	0.028	85.71	66.67	0.016

Golden Eagle	0.032	75.00	16.67	0.004
Ferruginous Hawk	0.067	70.59	25.00	0.012
Merlin	0.004	100	0.000	0.000
Northern Harrier	0.083	90.48	15.79	0.012
Prairie Falcon	0.008	100	50.00	0.004
Red-Tailed Hawk	0.044	63.64	14.29	0.004
Swainson's Hawk	0.917	69.26	24.38	0.155
Unidentified Buteo	0.083	80.95	23.53	0.016
Unidentified Falcon	0.008	100	50.00	0.004
Turkey Vulture	0.532	100	41.04	0.218
Corvids				
American Crow	0.107	96.30	38.46	0.040
Chihuahuan Raven	0.377	75.79	58.33	0.167
Common Raven	1.349	70.00	30.68	0.290
Unidentified Raven	0.202	58.82	43.33	0.051
Upland Game Birds				
Scaled Quail	0.163	85.37	0.000	0.000
Doves				
Mourning Doves	0.016	100	0.000	0.000
Cuckoos				
Greater Roadrunner	0.004	0.000	N/A	N/A
Woodpeckers				
Downy Woodpecker	0.004	100	0.000	0.000
Ladder-backed Woodpecker	0.004	0.000	N/A	
Red-Shafted Flicker	0.016	0.000	N/A	
Passerines				
Barn Swallow	0.099	96.00	12.50	0.012
Brown-Headed Cowbird	0.099	0.000	N/A	N/A
Cassin Sparrow	0.008	100	0.000	0.000
Carolina Wren	0.016	50.00	0.000	0.000
Chipping Sparrow	0.016	50.00	0.000	0.000
Common Grackle	0.004		0.000	0.000
Eastern Meadowlark	0.036	55.56	20.00	0.004
Horned Lark	0.151	84.21	40.63	0.052
Lark Bunting	2.274	78.53	0.000	0.000
Lark Sparrow	0.131	48.49	12.50	0.008
Loggerhead Shrike	0.048	16.67	50.00	0.004
Northern Mockingbird	0.024	16.67	0.000	0.000
Red-Winged Blackbird	0.028	100	100	0.028
Say's Phoebe	0.028	42.86	0.000	0.000

Scissor-Tailed Flycatcher	0.052	15.38	50.00	0.004
Song Sparrow	0.004	0.000	N/A	N/A
Swainson's Thrush	0.008	0.000	N/A	N/A
Western Bluebird	0.079	100	0.000	0.000
Western Kingbird	0.060	60.00	0.000	0.000
Western Meadowlark	0.365	19.57	16.67	0.012
White-Crowned Sparrow	0.016	50.00	0.000	0.000
Unidentified Sparrow	0.111	85.71	0.000	0.000
Unidentified Warbler	0.008	100	0.000	0.000

4.2 Lesser Prairie-Chicken Lek Surveys

During the 2009 field season, four lek surveys were conducted from April 1st to May 10th. Two leks were observed with one lek (Lek B) located outside the proposed project area (Figure 4). Lek A had 2 males and 4 females, and Lek B had 2 males and 6 females observed. Both leks were located adjacent to or near Western Great Plains sandhill shrubland plant community (Figure 4). Lek A was approximately 0.04 acres in size and was located in a small bowl with bareground and shorter grass (Figure 5).

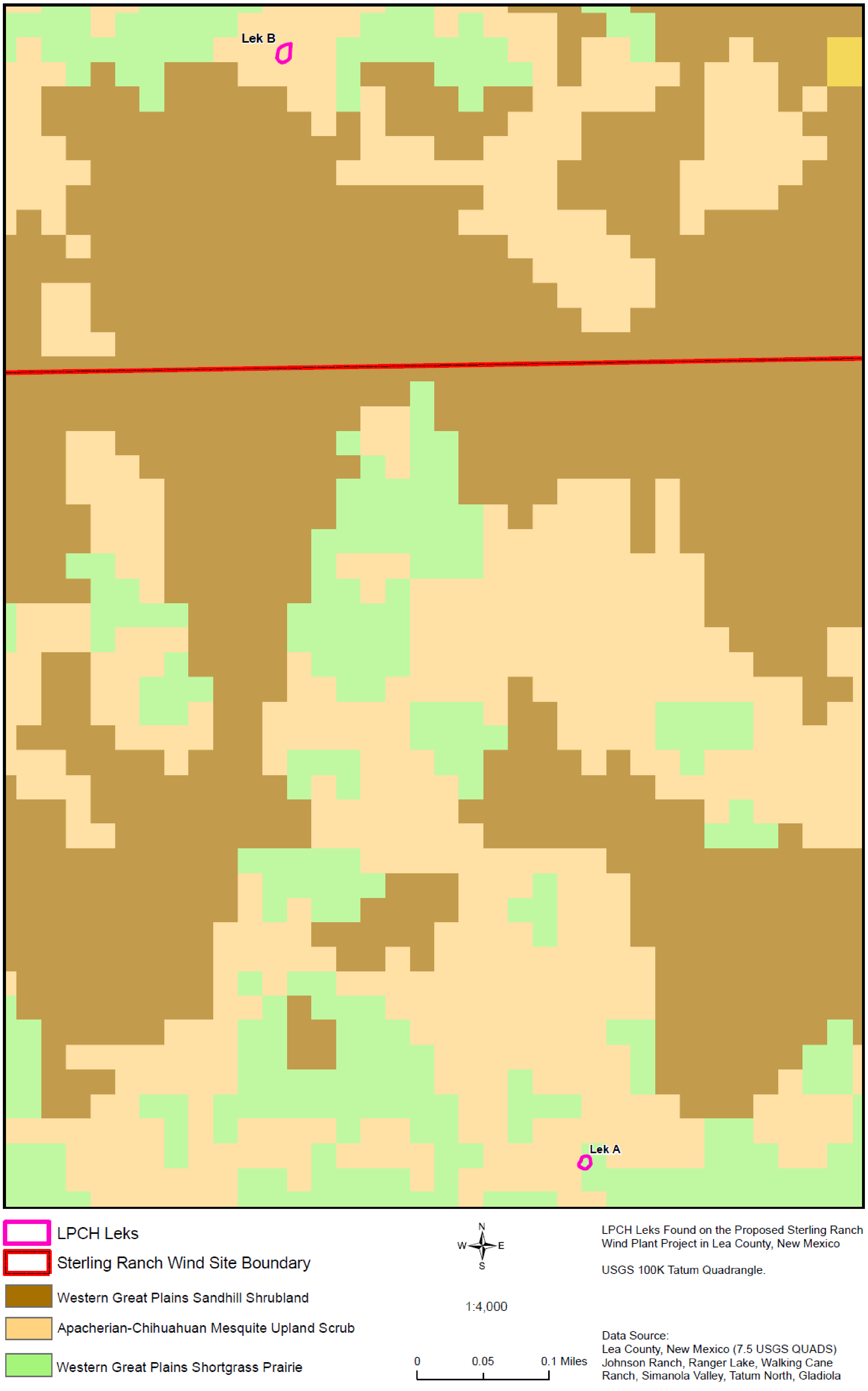


Figure 4. Lesser-Prairie Chicken (LPCH) Leks Observed on the proposed Sterling Ranch Wind Site, April – May 2009.

Figure 5. Lek A with 2 male Lesser-Prairie Chickens.

5.0 Summary and Conclusions

Avian Point Counts

Based on the fixed point count surveys, three species made up the vast majority of observations: lark bunting, common raven, and Swainson's hawk. Together these three species comprised more than half of all birds observed during the fixed point count surveys. The fourth most common bird observed was turkey vultures. Passerines were the most abundant group observed with approximately 4 individuals observed during each survey. Highest passerine uses occurred during the spring and fall due primarily to large flocks of lark buntings observed during these seasons.

Over all three seasons, the most abundant raptors observed in order were Swainson's hawk, turkey vulture, northern harrier, and American kestrel. On average approximately one Swainson's hawk was observed every survey, one turkey vulture every 2 surveys, one northern harrier every 13 surveys, and one American kestrel was observed every 36 surveys. The most abundant raptor varied by season, however, raptor use and raptor species observed were highest in the fall (Table 2). Similar to most other wind sites studied, raptor use dropped substantially during the winter.

Species Diversity

Frequency of occurrence and percent composition were calculated to provide a relative estimate of the avian diversity of the study area. These statistics reflect the results of the use calculations in that there is relatively low species diversity on the site with three species (Swainson's hawk, common raven, lark bunting) making up the vast majority of the observations. Based on frequency of occurrence two species were observed in over one- third of all surveys, Swainson's hawk (36%) and the common raven (35%). Swainson's hawk, common raven, and lark bunting made up approximately 57% of all bird use. Most species were observed in less than 5% of all surveys (Table 2).

The most frequently observed raptor was Swainson's hawk with 11.4% of total avian use (Table 3). Turkey vultures were observed approximately 15% of all surveys, and comprised 6.63% of all avian use. The common raven was observed approximately 35% of all surveys with 16.81% of all avian use (Table 3). In contrast lark buntings were observed in approximately 13% of all surveys, but comprised 28.34% of all avian use (Table 3).

Exposure Index

Common raven, long-billed curlew, and turkey vultures had the highest exposure indices (Table 6). Lark buntings were the most abundant species observed, but were all observed flying below the zone of risk, whereas the two large flocks of long-billed curlews were observed flying within the zone of risk. Raptor species with the highest exposure index were turkey vulture and Swainson's hawk. While the exposure index is not a measure of absolute risk, it does provide a relative estimate of the chance a species may come in contact with turbine blades. An exposure index of zero does not necessarily mean that a species is not at risk, but it does indicate that based on the observations made of that species on the site, it is unlikely to be in the area of the turbine blades for much of the time.

Mortality studies at other wind plants have commonly found few common raven casualties (Erickson *et al.* 2001). Although ravens are often observed at wind plants within the zone of risk, they appear to be less susceptible to collision with wind turbines than other similar size birds (e.g., raptors, waterfowl).

Passerines (perching birds) have been the most abundant avian fatality at some other projects studied (see Erickson *et al.* 2001), often comprising more than 80% of the avian fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines make up the vast majority of the avian observations on the Sterling Ranch site, passerines would likely make up the largest proportion of fatalities. Common species such as lark buntings would be most at risk.

Based on the relative low use of the study area by raptors, potential raptor mortality for this project is expected to be low. However, there were a couple of raptor nests observed near Point Count 15. The presence of nests may put adult birds of the nesting pair at greater risk while they actively attend young in the nest and may put fledgling juveniles at risk due simply to their proximity to turbines. The raptors and corvids expected to be most at risk of collision are the species most abundant in the study area, Swainson's hawk, turkey vultures, and common raven. Swainson's hawks have also been casualties at other studied wind plants (Erickson *et al.* 2001).

Raptor use of the Sterling Ranch site was higher compared to other wind plants studied. As a group, overall raptor use of the study area was approximately 1.8 raptors observed per 30-minute survey. For comparison, raptor use at three wind plants studied with the same methods varied from slightly lower to much lower. Raptor use at the Foote Creek Rim Wind Plant raptor use was approximately 1.10 raptors per 30-minute survey; at the Maiden 0.56 raptors per 30-minute survey; at the Buffalo Ridge Wind Plant raptor use was approximately 0.74 raptors per 30-minute survey.

Lesser-Prairie Chicken

A lesser prairie-chicken lek was observed on the proposed Sterling Ranch wind site. The lek observed was small in size and had 2 males and 4 females present. The lek is located approximately 1.2 miles west of point count 5. The U.S. Fish and Wildlife Service recommends placing wind turbines within 5 miles of a known lek (USFWS 2003).

6.0 Literature Cited

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APPENDIX D.
WINTER RAPTOR REPORT FOR THE PROPOSED STERLING WIND PROJECT

Winter Raptor Report for the Proposed Sterling Wind Project Lea County, New Mexico

March 2012

Prepared for:

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List of Abbreviations and Acronyms

AEM	AEM Energy, LLC
BGEPA	Bald and Golden Eagle Protection Act
BISON-M	Biota Information System of New Mexico
CBC	Christmas Bird Count
E & E	Ecology and Environment, Inc.
GIS	geographic information system
GPS	global positioning system
mph	miles per hour
MW	megawatt
NMGF	New Mexico Department of Game and Fish
NWCC	National Wind Coordinating Collaborative
Project	Sterling Wind Project
RSA	rotor-swept area
T/E	threatened or endangered
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WTG	wind turbine generator

Executive Summary

During the 2010-2011 winter, Ecology and Environment, Inc. (E & E) conducted a winter raptor study at the proposed Sterling Wind Project (Project) in Lea County, New Mexico in order to document the baseline winter raptor activity. Point-count style winter raptor surveys were conducted on five non-consecutive days: December 15 and 28, 2010, January 11 and 24, 2012, and February 16, 2012. Twenty bird survey points were used during the winter surveys: Raptor Point (RP) -01 through RP-20. The survey points were distributed across the Project area to ensure complete coverage of the site and to ensure that all habitats of the Project area were represented.

Seven raptor species were recorded on or adjacent to the Project area during the winter raptor study. The Ferruginous Hawk was the only species observed during all five surveys, and the number of individuals recorded ranged between two to six. The Northern Harrier, Golden Eagle, and American Kestrel were recorded during four of the five surveys. The number of individuals of Northern Harriers observed using the Project area or the adjacent areas ranged between two and five birds on days when the species was detected. The number of Golden Eagles observed ranged between one and three birds on days when birds were detected. Either one or two American Kestrels were observed on days when the species was recorded.

There was only a single observation of each of the following species: Red-tailed Hawk, Rough-legged Hawk, and Prairie Falcon. Four raptors were observed that could not be identified to species level; one of these four raptors was identified down to genus level (Buteo spp.).

During the study, raptors were observed both roosting and foraging in the Project area and adjacent land. Based on field observations of forging raptors and the presence of prey items in the form of black-tailed jackrabbits and Scaled Quail, as well as the occurrence of small rodent burrows throughout the Project area, there appears to be a base level of suitable prey to support winter raptors in the Project area. Brush piles, which can provide adequate cover for small mammals were present in the eastern portion of the Project area. E & E recommends removing these brush piles from the Project area before beginning operation of the Project to reduce the manmade cover that could support suitable raptor prey. Prairie dogs, which can be a major source of prey for raptors, were not observed in the Project

area. Because food resources were not formally evaluated during the winter raptor study, the degree to which food resources are a limiting factor in the region cannot be directly measured. The observation of raptors using the adjacent habitats in addition to the Project area to forage and roost during the study indicates that adjacent habitats also contain prey sources and the Project area does not serve as an isolated food source within the landscape.

The results of the winter raptor study indicate that the Project does support a diverse winter raptor community that would be expected for this location in New Mexico and for the habitat present within the Project area. There were no federally listed or state-listed threatened or endangered (T/E) raptor species observed during the study. Although the Project area does appear to support a baseline level of suitable raptor prey, the Project does not appear to be a concentration point for winter raptors.

1 Introduction

1.1 Project Background

AEM Energy, LLC (AEM) is proposing to construct and operate the Sterling Wind Project (Project) in Lea County, New Mexico. The 50-megawatt (MW) Project consists of 18 wind turbine generators (WTG) and will encompass approximately 3,019 acres (4.7 square miles) of rangeland owned by the Sterling family in southeastern New Mexico. The Project will consist of WTGs, associated access roads, underground electricity collection lines, and a substation. The locations of WTGs and other structures associated with the Project have not been finalized at this time. A map of the proposed Project area is provided in Figure 1-1.

AEM requested that E & E conduct a preconstruction winter raptor study at the Project, both as a matter of due diligence and in response to requests from the United States Fish and Wildlife Service (USFWS) and the New Mexico Department of Game and Fish (NMGF), to gather data to verify the anticipated low raptor activity in the Project area. The results of the winter raptor study are described in this report and can be used by AEM to understand and minimize any potential impacts on winter raptors from the construction and operation of the Project.

1.2 Wind Energy and Winter Raptor Issues

Using wind energy to generate electricity without many of the environmental impacts associated with other energy sources (e.g., air pollution, water pollution, mercury emissions, and climate change) could benefit birds, bats, and many other plant and animal species. However, possible adverse impacts of wind facilities on birds and their habitats have been documented and continue to be an issue. Populations of many bird species are experiencing long-term declines, due in part to habitat loss and fragmentation, encroachment of invasive species, and numerous human impacts, increasing the concern over the potential effects of energy development.

Although few published studies have focused specifically on the interactions between winter raptors and wind energy facilities in south central United States, specifically New Mexico or Texas, there have been studies that have evaluated the year-round interactions of raptor and wind energy facilities. Raptors have been impacted by wind generation projects at several locations in North America; however, impacts have been most severe at wind generation sites in California. Most notably, the Altamont Pass Wind Resource Area (5,000 turbines) and the Los Angeles Department of Water and Power's Pine Tree Wind Farm (90 turbines) in California have had high overall avian fatality rates and high Golden Eagle fatalities. It is estimated that approximately 67 Golden Eagles are killed at Altamont Pass Wind Resource Area each year, while six Golden Eagle deaths have been attributed to the Pine Tree Wind Farm in the Tehachapi Mountains over its two-year operation. Recently, two more Golden Eagles were found dead at Pine Tree Wind Farm, although the USFWS is still determining the cause of death (Sahagun February 16, 2012). Several site-specific features at the Altamont Pass Wind Resource Area contribute to the number of raptor deaths, including older turbines that allow raptors to perch and nest on lattice structures; the large number of turbines (more than 5,000) that are closely spaced; an abundant source of prey; and the ridgeline topography (Government Accountability Office 2005). In stark contrast to these California facilities, large numbers of raptor fatalities have not been documented at wind facilities throughout the remainder of the United States, and raptor fatalities have been estimated to be from 0.0 to 0.07 raptors/turbine/year for developments not located in California (Government Accountability Office 2005). Additionally, post-construction studies have shown that there is no relationship between habitat type and raptor fatality rates (Strickland et al. 2011).

To minimize potential impacts on raptors, raptor studies are often a component of the pre-construction due diligence. Pre-construction bird studies provide a measure of the level of bird use and characterize bird behavior, which is an important factor in assessing the potential risk to birds from the operation of a wind farm (Barrios and Rodríguez 2004; Kuvlesky et al. 2007; National Wind Coordinating Collaborative 2010). In a 2011 report, the National Wind Coordinating Collaborative (NWCC) compared publically available raptor abundance and fatality data at 13 wind generation facilities across the United States and found that "abundance is very likely one of the most important predictors of the risk of fatalities for raptors" (Strickland et al. 2011), while others have asserted that species-specific flight behavior on a site-specific basis is a stronger predictor of collision fatalities than abundance (Lucas et al. 2008).

1.3 Winter Raptors of New Mexico

Through a review of range maps (Sibley 2000), regional Christmas Bird Count (CBC) results (National Audubon Society 2012), and the Biota Information System of New Mexico (BISON-M), eleven raptor species were identified as potentially occurring in Lea County, New Mexico, during the winter (see Table 1-1). None of these raptor species are federally listed or state-listed as T/E species, though the Golden Eagle is federally protected through the Bald and Golden Eagle Protection Act (BGEPA).

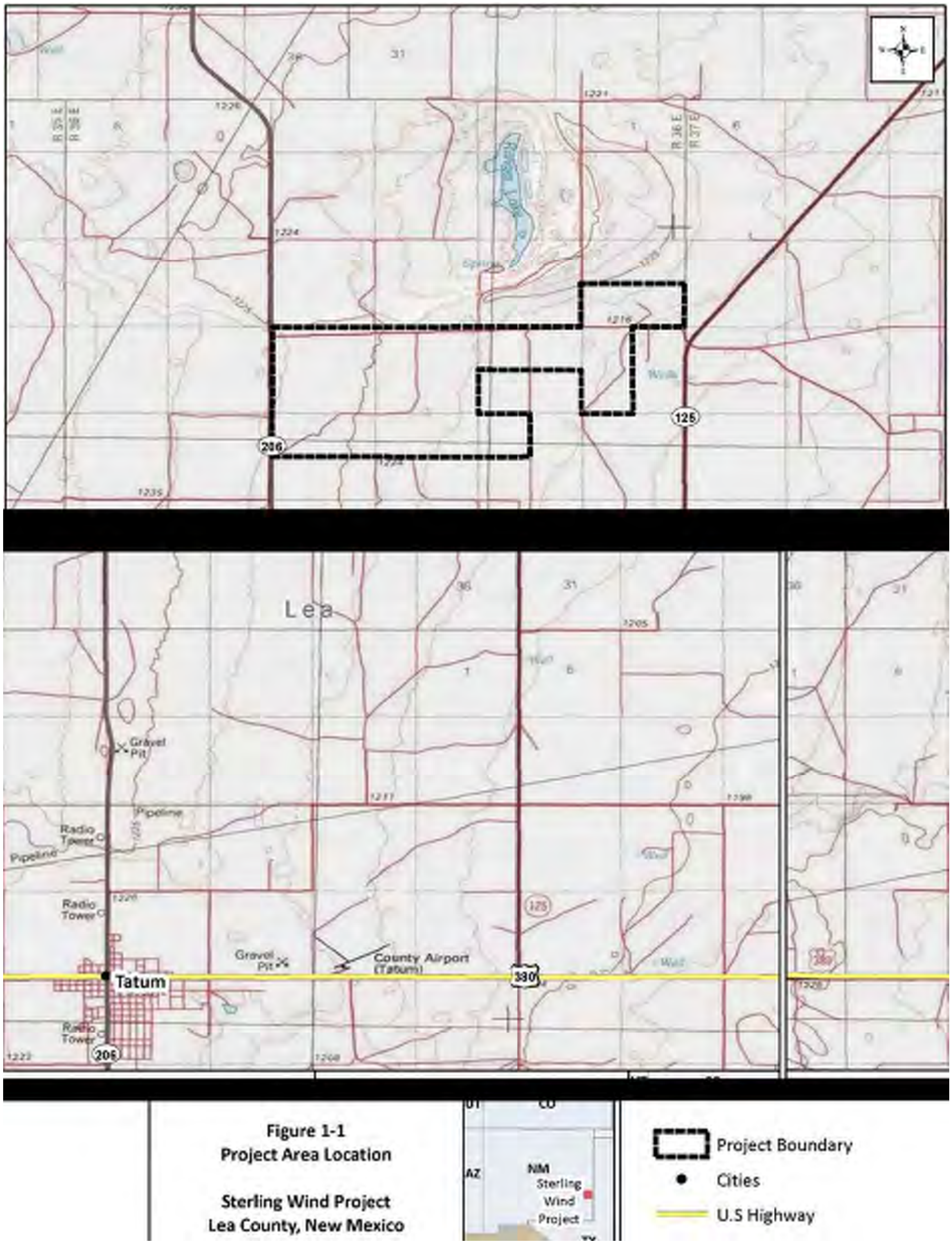

Figure 1-1 Project Area Location, Sterling Wind Project

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Table 1-1 List of Potential Raptor Species at the Sterling Wind Project

Common Name	Status[1]	Residence[2]	Habitat Preference
Northern Harrier (*Circus cyaneus*)	--	Winter[3]	Wintering: Open areas dominated by herbaceous vegetation.
Sharp-shinned Hawk (*Accipiter striatus*)	--	Winter[3]	Wintering: Open and forested habitats, including farmland and suburbs; frequents bird feeders.
Cooper's Hawk (*Accipiter cooperii*)	--	Winter[3]	Wintering: Agricultural land and forested areas; frequents bird feeders.
Harris's Hawk (*Parabuteo unicinctus*)	--	Year-round[3]	Breeding and Wintering (does not migrate): Deserts, savannahs, grasslands, wetlands; in New Mexico primarily in stands of large mesquite or live oak.
Red-tailed Hawk (*Buteo jamaicensis*)	--	Year-round[3]	Breeding: Semi-open habitats; perch and nest on elevated sites (i.e., trees, cacti, cliff faces, man-made structures). Wintering: Open to semi-open habitats with elevated perch sites.
Ferruginous Hawk (*Buteo regalis*)	--	Winter[3]	Wintering: Open habitats; most common around prairie-dog towns or agricultural fields with pocket gophers.
Rough-legged Hawk (*Buteo lagopus*)	--	Winter[3]	Wintering: Open habitats.
Golden Eagle (*Aquila chrysaetos*)	BGEPA	Winter[3]	Wintering: Open habitats preferably with native vegetation; will use sagebrush, grassland, riparian, and rolling oak savannah habitats, including grazed areas.
Merlin (*Falco columbarius*)	--	Winter[3]	Wintering: Open forests and grasslands.
American Kestrel (*Falco sparverius*)	--	Year-round[3]	Breeding: Open to semi-open habitats with appropriate perch and nest trees. Wintering: Open to semi-open habitats; often with more woody vegetation than breeding season habitat and presence of suitable nest trees not required.
Prairie Falcon (*Falco mexicanus*)	--	Year –round[4]	Breeding: Open habitats with suitable cliffs or bluffs nearby for nesting sites. Wintering: Open habitats.

[1] Status key: BGEPA: Bald and Golden Eagle Protection Act
[2] Residence in Lea County, NM
[3] Sibley 2000
[4] Steenhof 1998

2 Project Habitat

The Project area encompasses approximately 3,019 acres of rangeland with little topographic relief in southeastern New Mexico. Land use/land cover geographic information system (GIS) data from the United States Geological Survey (USGS) shows the Project area consists almost exclusively of grassland/herbaceous land cover (2,968.5 acres [98.3%]) with minor areas of shrub/scrub habitat (48.5 acres [1.6%]) and developed land (2.3 acres [0.1%]) (see Figure 2-1).

During previous site visits E & E (2008 and 2010-2011) noted that the vegetation of the Project area is characterized by heavily grazed, former shortgrass prairie interspersed with sparse patches of mesquite (*Prosopis glandulosa*) and cane cholla cactus (*Cylindropuntia imbricata*). Mesquite is the dominant woody cover within the shrub/scrub habitats on-site and is more common in the western half of the Project area, while the eastern half of the Project area is characterized by more open land with a higher density of cane cholla cactus. There are no large trees in the Project area (see site photographs in Appendix A.)

The only water sources in the Project area are cattle ponds that are fed by windmill-driven wells. The major waterbody closest to the Project is Ranger Lake, approximately 0.5 miles to the north of the northern Project boundary. Ranger Lake is a hypersaline waterbody that is only seasonally flooded.

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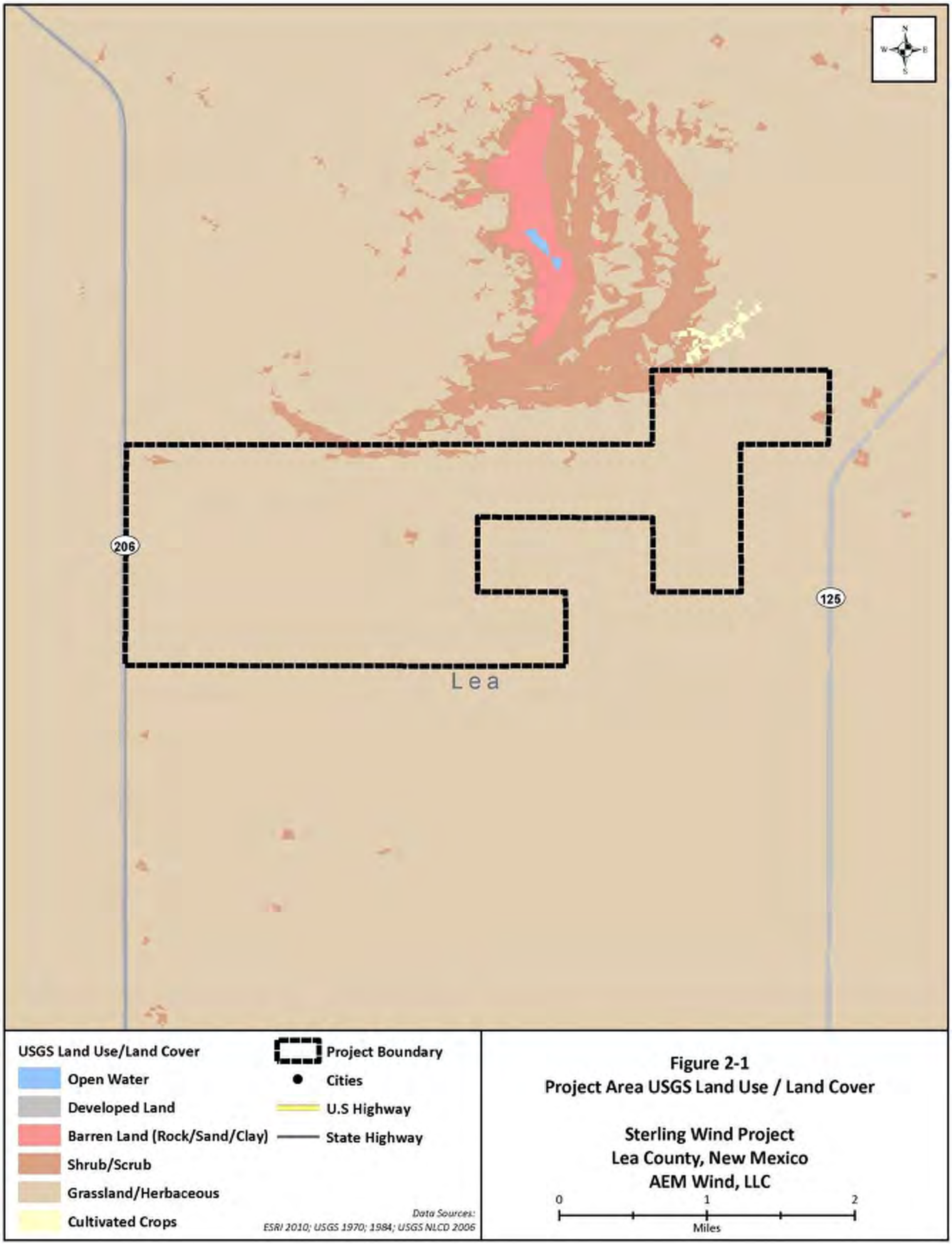

Figure 2-1 Project Area USGS Land Use/Land Cover, Sterling Wind Project

3 Methods

Winter Raptor Surveys

E & E conducted a baseline winter raptor study in the Project area during the 2010-2011 winter season. The winter raptor surveys were conducted on five non-consecutive days: December 16 and 28, 2010, and January 11 and 24, 2012, and February 16, 2012.

Twenty bird survey points were used during the winter surveys: Raptor Point (RP) -01 through RP-20. The survey points were distributed across the Project area to ensure complete coverage of the site and to ensure that all habitats of the Project area were represented. Survey points were established along existing two-lane and two-track roads that were located within or bordering the Project area. Figure 3-1 displays the locations of all 20 survey points, and Appendix C, Table C-1, lists the global positioning system (GPS) coordinates of each survey point. Representative photographs taken at the survey points are included in Appendix A.

During each survey a single observer documented all raptor species identified by sight or sound during a specific time period. The initial survey time period spent at each raptor survey point used during the December 15, 2011 survey was 20 minutes for all 20 survey points, but this was shortened to 15 minutes for the remaining four surveys based on E & E's determination that a 15-minute survey was more efficient and provided comparable data. All raptors detected during the survey were identified to species when possible, and the location of the bird was estimated, mapped, and described by a distance and azimuth. The exact location of some observed birds could not be determined due to f the distance of the bird from the survey point; however, estimates of bird locations were based on the bird's relationship to known landmarks within the Project area, which allowed E & E to assume relative accuracy of mapped bird locations. Additional information that was recorded when possible included sex, age, behavior, habitat, flight height, and flight direction.

Each survey was conducted on a single day starting between 7:24 a.m. and 8:05 a.m. and concluding between 3:35 p.m. and 4:52 p.m. The order in which the survey points were surveyed was alternated between replications to reduce survey bias due to the time of day. Because of the size and openness of the Project area, which allowed a line of sight from any of the 20 surveys points throughout the airspace of nearly the entire Project area, the survey points were not considered independent of each other and so comparisons of raptor activity levels from point to point were not made. Rather, the surveys provided an index of raptor activity across the entire Project area. All raptors were recorded either as a new individual for that survey day or as a re-sighting. Re-sighted raptor individuals are not counted towards the total number of raptors observed. Flight direction and movement of each observed raptor were recorded on a map to allow the observer to track the movements of each raptor so that individuals were not re-counted as new individuals.

In addition to recording all raptor species that were observed during the surveys, all observations of other bird species and of other wildlife species were recorded. Precipitation, temperature, wind speed, wind direction, and cloud cover were recorded at each survey point.

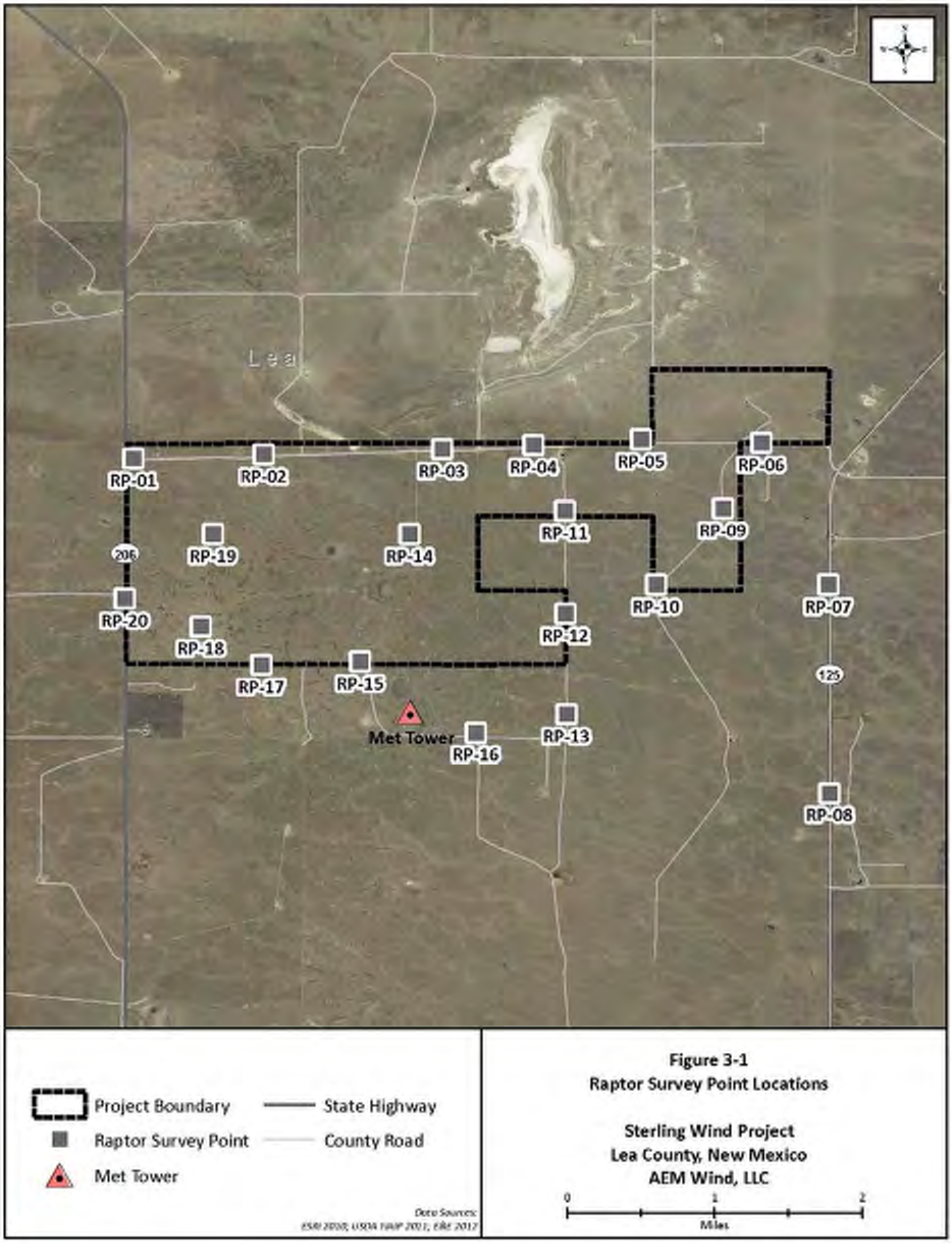

Figure 3-1 Raptor Survey Point Locations, Sterling Wind Project

4 Results

Winter Raptor Surveys

The December 15 20-minute surveys were conducted at all 20 survey points (RP-01 through RP-20) for a total of 400 survey minutes.

The January 11 and 24 and February 16, 15-minute surveys were conducted at all 20 survey points (RP-01 through RP-20) for a total of 300 survey minutes during each day.

Snow on the ground and muddy conditions of the two-track roads during the December 28 survey restricted vehicle travel and staff had to walk to several of the survey points. Because of the extra time needed to walk from point to point, survey time at some points was reduced to ten minutes. However, the observer was still able to make observations while walking between points. Thus, 15-minute surveys were conducted at survey points RP-02, RP-05 through RP-08, RP-14, and RP-15. Ten-minute survey times were conducted at RP-09, RP-11 through RP-13, and RP-15 through RP-19. Survey points RP-01, RP-03, RP-04, and RP-10 were not surveyed on December 28 due to time constraints resulting from the additional travel time due to walking. However, adjacent and nearby completed survey points provided coverage of the area of the omitted survey points. Total survey time on December 28 was 195 minutes plus a minimum of an additional 90 minutes of observation time while walking between points.

Weather conditions recorded at the Project during the winter raptor study (see Appendix C) were typical seasonal conditions for the region and generally acceptable for winter raptor surveys (Weather Underground 2012). Wind speeds averaged between 5.5 miles per hour (mph) and 21.1 mph with an overall average of 12.3 mph. The highest wind speeds occurred during the January 11, 2012 survey (average 21.2 mph; gusts up to 34.5 mph) but did not appear to have an impact on raptor activity. Precipitation was recorded only during the last three raptor survey points surveyed on December 15, 2011. The precipitation was a light intermittent rain, and raptor activity continued to be observed.

Raptor Activity

Seven raptor species were recorded on or adjacent to the Project area during the winter raptor study. (Table 4-1 is a summary of raptor observations. Appendix D provides a complete description of all raptor observations.).The Ferruginous Hawk was the only species observed during all five surveys, with the number of individuals ranging between two to six. The Northern Harrier, Golden Eagle, and American Kestrel were recorded during four of the five surveys. The number of individuals of Northern Harriers observed using the Project area or the adjacent areas ranged between two and five birds on the days when the species was detected. The number of Golden Eagles observed ranged between one and three birds on days when the species was detected. On days when the America Kestrel was observed, either one or two birds were noted.

Table 4-1 Summary of Winter Raptor Observation by Date, Sterling Wind Project, Lea County, New Mexico

Species	Survey Date					Average Number of Birds Per Survey
	2010		2011			
	12/15	12/28	01/11	01/24	02/16	
Northern Harrier (*Circus cyaneus*)	2	5	0	4	2	**2.6**
Red-tailed Hawk (*Buteo jamaicensis*)	0	0	0	1	0	**0.20**
Ferruginous Hawk (*Buteo regalis*)	5	2	2	6	2	**3.4**
Rough-legged Hawk (*Buteo lagopus*)	0	0	1	0	0	**0.20**
Unknown Buteo	1	0	0	0	0	**0.20**
Golden Eagle (*Aquila chrysaetos*)	2	3	0	1	2	**1.6**
American Kestrel (*Falco sparverius*)	1	2	1	2	0	**1.2**
Prairie Falcon (*Falco mexicanus*)	0	0	1	0	0	**0.20**
Unknown Raptor	1	0	1	1	0	**0.6**
Total Number of Birds	**12**	**12**	**6**	**15**	**6**	**--**
Total Number of Species[1]	**4**	**4**	**4**	**5**	**3**	**--**

[1] The calculation of the total number of species does not include unknown Buteo spp. or unknown raptors.

There was only a single observation of Red-tailed Hawk, Rough-legged Hawk, and Prairie Falcon.

Four raptors were observed that could not be identified to species level; one of these four raptors was identified down to genus level (Buteo spp.)These four individuals could not be positively identified to species because of the distance between the bird and the observer and/or an abbreviated observation time. Field observations indicate that the unknown raptor species were larger raptor species, possibly consisting of either the Northern Harrier, Buteo species, or Golden Eagle.

The following non-raptor bird species that were observed while conducting the winter raptor surveys: Mallard (*Anas platyrhynchos*), Gadwall (*Anas strepera*), Green-winged Teal (*Anas crecca*), Scaled Quail (*Callipepla squamata*), Sandhill Crane (*Grus canadensis*), Greater Roadrunner (*Geococcyx californianus*), Loggerhead Shrike (*Lanius ludovicianus*), Chihuahuan Raven (*Corvus cryptolecus*), Raven spp. (Corvus spp.), Horned Lark (*Eremophila alpestris*), Sage Thrasher (*Oreoscoptes montanus*), Lark Bunting (*Calamospiza melanocorys*), and meadowlark species (*Sturnella* spp.). All of these non-raptor species were observed using the habitat within the Project area, except for the sandhill cranes, which were observed flying over the Project area in small flocks at heights well above the anticipated rotor-swept area (RSA) of approximately 50 to 400 feet above ground level.

Additional wildlife observed included coyotes (*Canus latrans*), black-tailed jackrabbit (*Lepus californicus*), and pronghorn (*Antilocarpa americana*).

5 Discussion

The purpose of the preconstruction winter raptor study was to focus on collecting baseline information regarding winter raptor activity levels in the Project area. This winter raptor study was conducted as a matter of due diligence and based on recommendations from the USFWS and NMGF.

Northern Harrier

Northern harriers were observed on four of the five survey days, and the number of birds observed ranged between two to five birds each survey day for a total of 13 observations. Observations of Northern Harriers were made across the Project area and on land adjacent to the Project area (see Figure 5-1). The winter range of the Northern Harrier overlaps with the Project area but the Project area is not in the breeding range of the species (Sibley 2000). The occurrence of the Northern Harrier is not unexpected during the winter because the Project contains suitable overwintering habitat (i.e., open habitats dominated by herbaceous vegetation). Eleven of the thirteen birds observed were flying below the anticipated RSA and appeared to be foraging, based on their observed flight behavior. One bird was observed flying at a height above the anticipated RSA and one bird was perched. The plumage of the majority of the birds observed indicated they were either female or juvenile; only one adult male bird was observed during the study.

Observations during the winter raptor study suggest that two to four winter Northern Harriers are residents that regularly include the Project area as part of their winter range.

Ferruginous Hawk

The Ferruginous Hawk was the only raptor species that was observed during all five surveys, with the number of birds observed on a single day ranging between two and six birds, for a total of 17 observations. Observations of Ferruginous Hawks were made across the Project area (see Figure 5-2). Ferruginous hawks were observed perching on power lines adjacent to the Project area along State Highway 206 and State Highway 125, perched within the Project area on the ground and on mesquite shrubs, and flying within the Project area from within the RSA to above the anticipated RSA. The Project area is in the winter range of the Ferruginous Hawk but is not within the breeding range of the species (Sibley 2000). The occurrence of the Ferruginous Hawk is not unexpected because the Project contains suitable overwintering habitat (i.e., open habitat, grasslands).

The observations made during the winter raptor study noted at least three to four Ferruginous Hawks that were consistently using the Project area or the habitat directly adjacent to the Project area. The maximum number of birds observed within the Project area at one time was four birds on December 15, 2011, and all four birds were observed congregating together. One to two other individuals consistently used the transmission line that borders State Highway 125 near RP-08. This transmission line is outside of the boundaries of the Project area.

Golden Eagle

Golden Eagles were observed on four out of the five surveys, and the number of birds observed during these four surveys ranged between one to three birds, for a total of eight observations. The observed individuals were concentrated in the western and south-central portions of the Project area and adjacent areas (see Figure 5-3). The observed birds appeared to favor the western portion of the Project area, which has more woody vegetation (i.e., mesquite). The Golden Eagle is a winter resident of the Project area, but the Project area is not within the breeding range of the species (Sibley 2000; Kochert et al. 2002; DeLong 2004). The occurrence of the Golden Eagle is not unexpected because the Project contains suitable overwintering habitat (i.e., open habitat with native vegetation). All observed birds were initially observed perched. Substrate that was used for perches included transmission poles (see Photo 5, Appendix A), fence line, and mesquite shrubs. Some individuals were flushed during the survey and were observed flying at heights below, within, and above the anticipated RSA. All birds observed were juveniles or first-year sub-adults (see Photo 6 in Appendix A for a photograph of a juvenile Golden Eagle observed on February 16, 2012).

Observations made during the winter raptor study indicate two to three winter resident Golden Eagles include the Project area as part of their winter range. None of the birds were of breeding age and thus support the assumption that the observed birds are probably only wintering within the Project area.

American Kestrel

The American Kestrel was the observed on four out of the five survey days, and the number of birds observed during these four surveys ranged between one to two birds, for a total of six observations. Observations of American Kestrels were concentrated in two spots during the study: one location was north of Ranger Lake Road, near survey points RP-04 and RP-05, and the second location was east of State Highway 125 near survey points RP-07 and RP-09 (see Figure 5-4). All initial observations of American Kestrels were of birds located outside the Project area, with only one observed on December 28, 2011, seen entering the Project area. American Kestrels were observed perching on low-lying vegetation, fence lines, or power lines, and were commonly exhibiting behaviors indicating that the individuals were hunting. All observed flights of the birds were below the anticipated RSA. The American Kestrel is a year-round resident of the Project

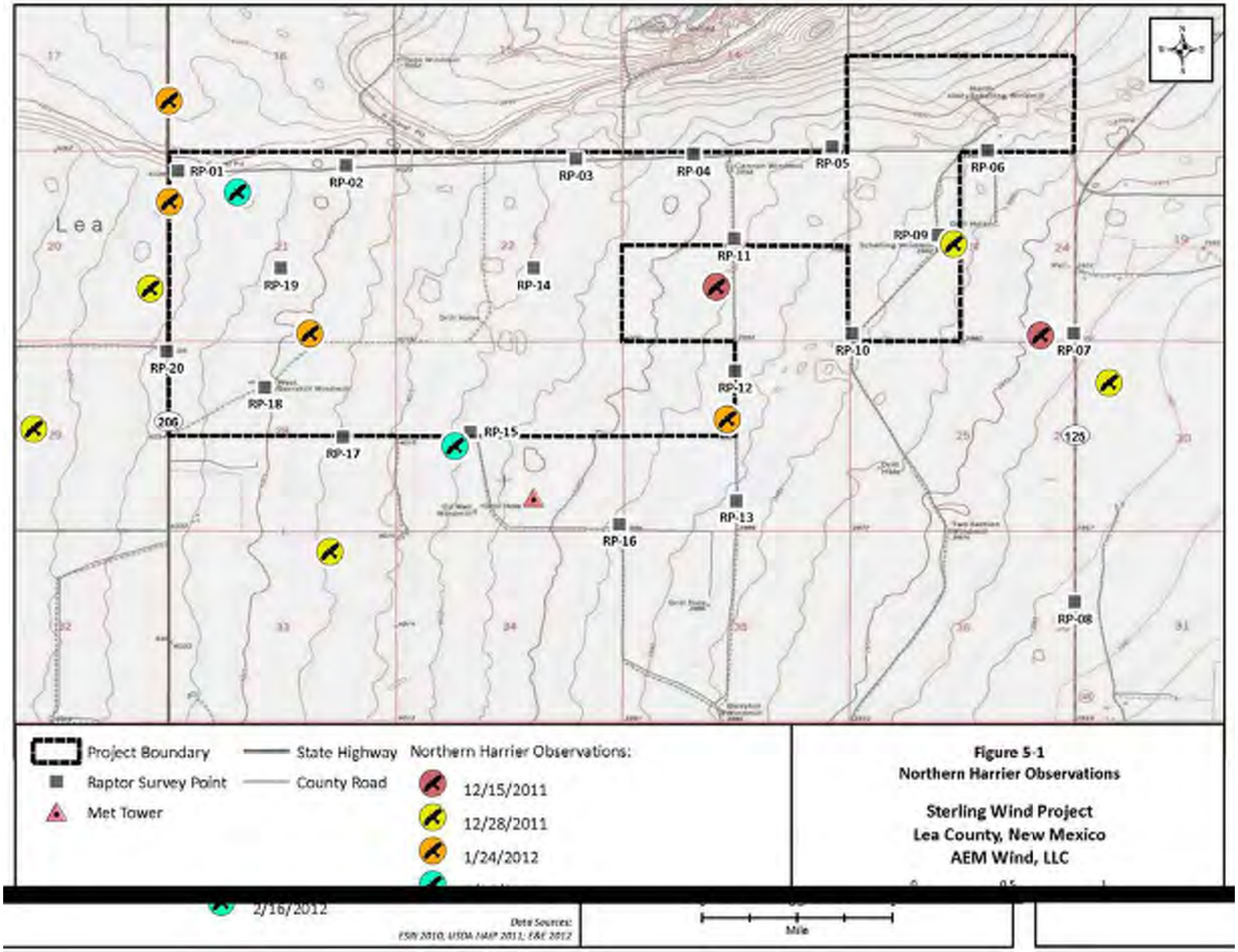

Figure 5-1 Northern Harrier Observations during the 2010-2011 Winter Raptor Study, Sterling Wind Project

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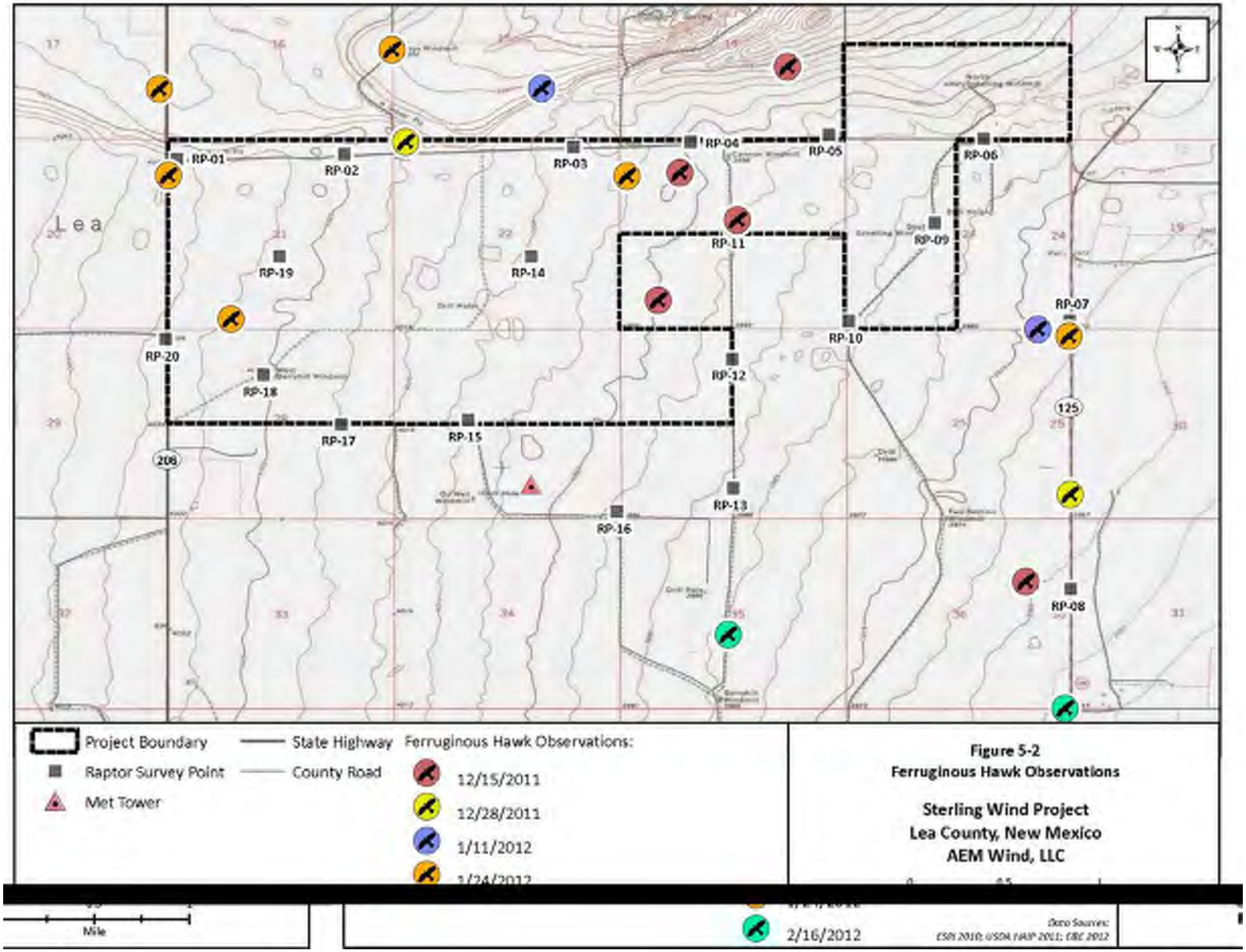

Figure 5-2 Ferruginous Hawk Observations during the 2010-2011 Winter Raptor Study, Sterling Wind Project

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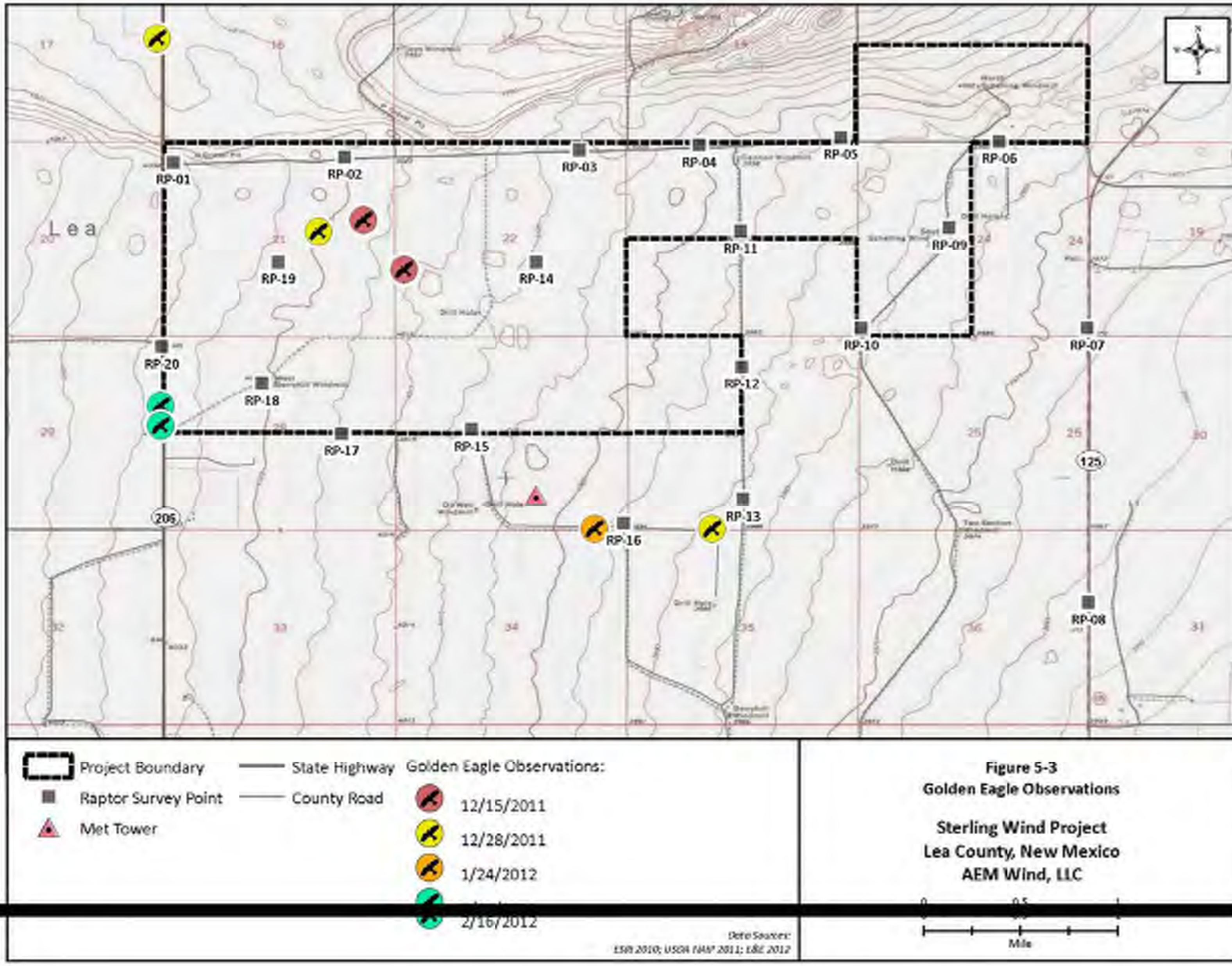

Figure 5-3 Golden Eagle Observations during the 2010-2011 Winter Raptor Study, Sterling Wind Project

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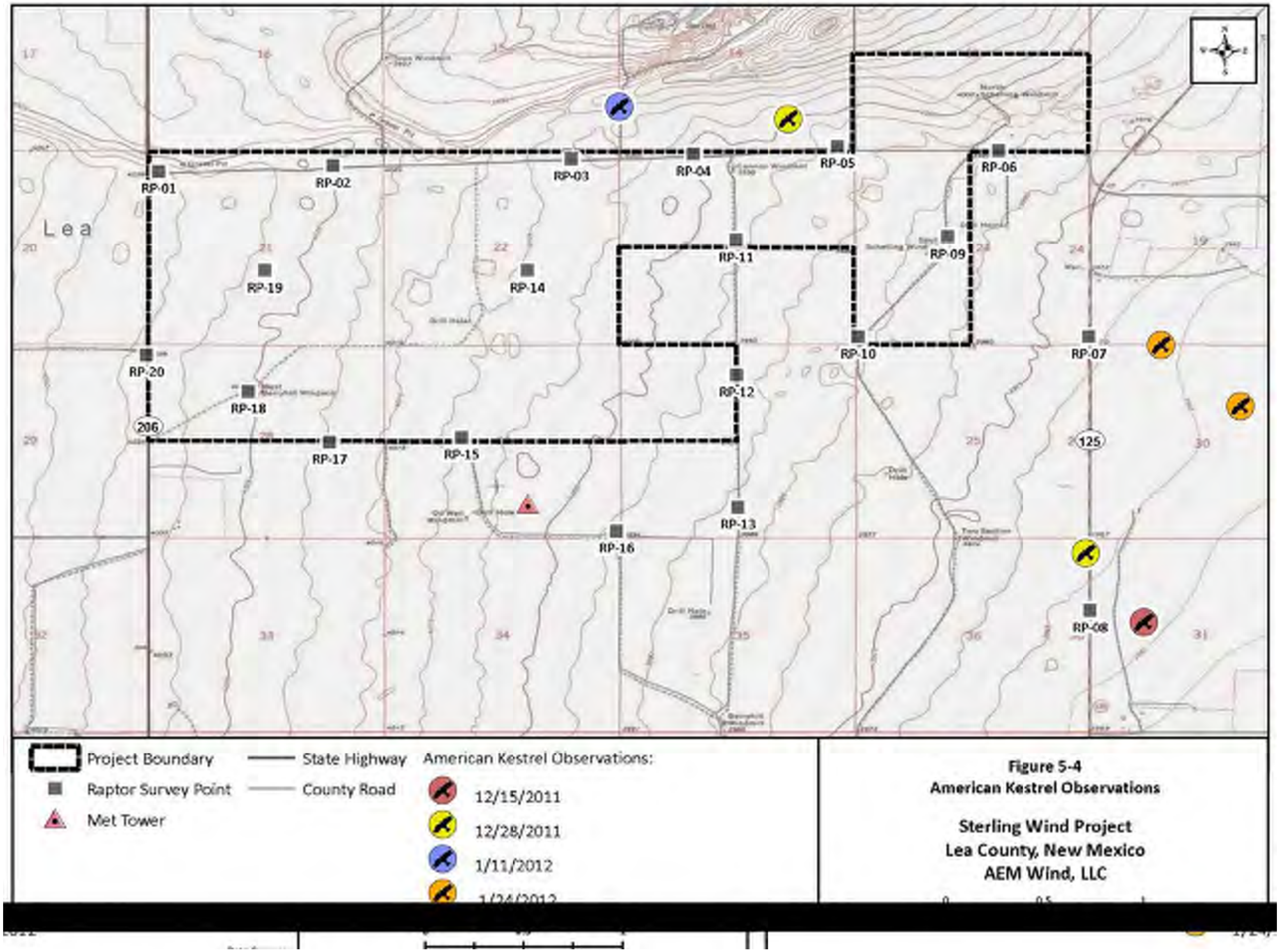

Figure 5-4 American Kestrel Observations during the 2010-2011 Winter Raptor Study, Sterling Wind Project

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area (Sibley 2000) and the occurrence of the individuals during the winter is not unexpected because the Project contains suitable overwintering habitat (i.e., open habitat, grasslands).

Observations made during the winter raptor study indicate at least two to three American Kestrel consistently use the Project area or the habitat directly adjacent to the Project area. The observed birds tended to occupy areas directly adjacent to the Project area and preferred an open grassland habitat (see Photo 4, Appendix A) that contained less woody vegetation than found on much of the Project area.

Red-tailed Hawk

The only observation of a Red-tailed Hawk was a single bird on January 24, 2012, perched outside of the Project area on the transmission line that borders State Highway 125 (see Figure 5-5). The Red-tailed Hawk is a year-round resident of New Mexico, and the habitat of the Project area is suitable to support wintering Red-tailed Hawks. However, the single observation of this species suggests that the Red-tailed Hawk is not common in the Project area and is unlikely to occur frequently.

Rough-legged Hawk

Only one Rough-legged Hawk was observed during the winter raptor study—a single bird perched on the ground near survey point RP-10 (see Figure 5-5). During the survey, the bird was flushed and flew at a height below the anticipated RSA to the west and was not observed again during the survey. Although the southern limit of the Rough-legged Hawk's winter range encompasses the Project area (Sibley 2000), the southern extent of this species' winter range is known to vary from year to year, depending on the winter conditions (Bechard and Swem 2002). The Project area does support suitable winter habitat, i.e., open grasslands, but because the Project area is at the southern-most extent of the species' range, the Rough-legged Hawk is not expected to regularly occur within the Project area during the winter.

Prairie Falcon

There was single observation of a Prairie Falcon, on January 11, 2012, near the Project's meteorological tower (see Figure 5-5). The individual appeared to be foraging and was observed flying below, within, and above the anticipated RSA. However, although occurrence was not unexpected because Prairie Falcons are year-round residents throughout New Mexico (Steenhof 1998) and the Project area does contain suitable winter habitat (open grasslands), the Prairie Falcon was observed only once during the winter study, suggesting that the Prairie Falcon is not likely to regularly occur within the Project area during the winter.

Conclusions

The winter raptor study recorded a total of seven species of raptors using the Project area or the land directly adjacent to the Project area. Raptors were observed both roosting and foraging in the Project area. A base level of suitable prey items to support winter raptors appears to be available based on observations of forging raptors and of small rodent burrows (see Photo 7, Appendix A), although no small rodents were observed. Scaled Quail and black-tailed jack rabbits were also observed, both of which are suitable food resources for winter raptors. Prairie dogs, which can be a major source of prey for raptors, were not observed in the Project area. The observation of raptors using the adjacent habitats to forage and roost indicates that these habitats also contain prey sources and that the Project area is not an isolated food source within the landscape. Because food resources were not formally evaluated during the winter raptor study, the degree to which food resources are a limiting factor in the region cannot be directly measured.

Brush piles (see Photo 8, Appendix A) can provide cover for prey species, including rodents, rabbits, and quail. Scaled Quail and black-tailed jack rabbits were observed using brush piles in the Project area. To reduce the density of available prey at the Project, E&E recommends removing brush piles from the Project area before beginning operations.

Table 5-1 compares the maximum number of detections for a single raptor species on any given survey day during the winter raptor survey at the Project and during the 2011 Audubon Christmas Bird Counts at two nearby CBC circles, the Clovis CBC and the Eunice-Lea CBC, to compare the diversity and density of the raptors at the Project with the surrounding area. The Clovis CBC circle is located approximately 74 miles to the north of the Project area in Clovis, New Mexico, and the Eunice-Lea CBC circle is located approximately 76 miles to the south of the Project area near Eunice, New Mexico.

CBCs are conducted annually, mostly by volunteers, during an all-day census within 15-mile-diameter circular survey areas. The primary objective of the CBC is to monitor the status and distribution of wintering bird populations across the Western Hemisphere. The results are compiled into the longest-running database in ornithology, representing more than a century of continuous data on trends of early winter bird populations across the Americas (National Audubon Society 2012). Although the results of the CBC counts and the winter raptor study are not directly comparable due to different survey protocols and a different composition of habitats surveyed, the comparison does show that the winter raptor community observed at the Project area is similar to that observed in the region.

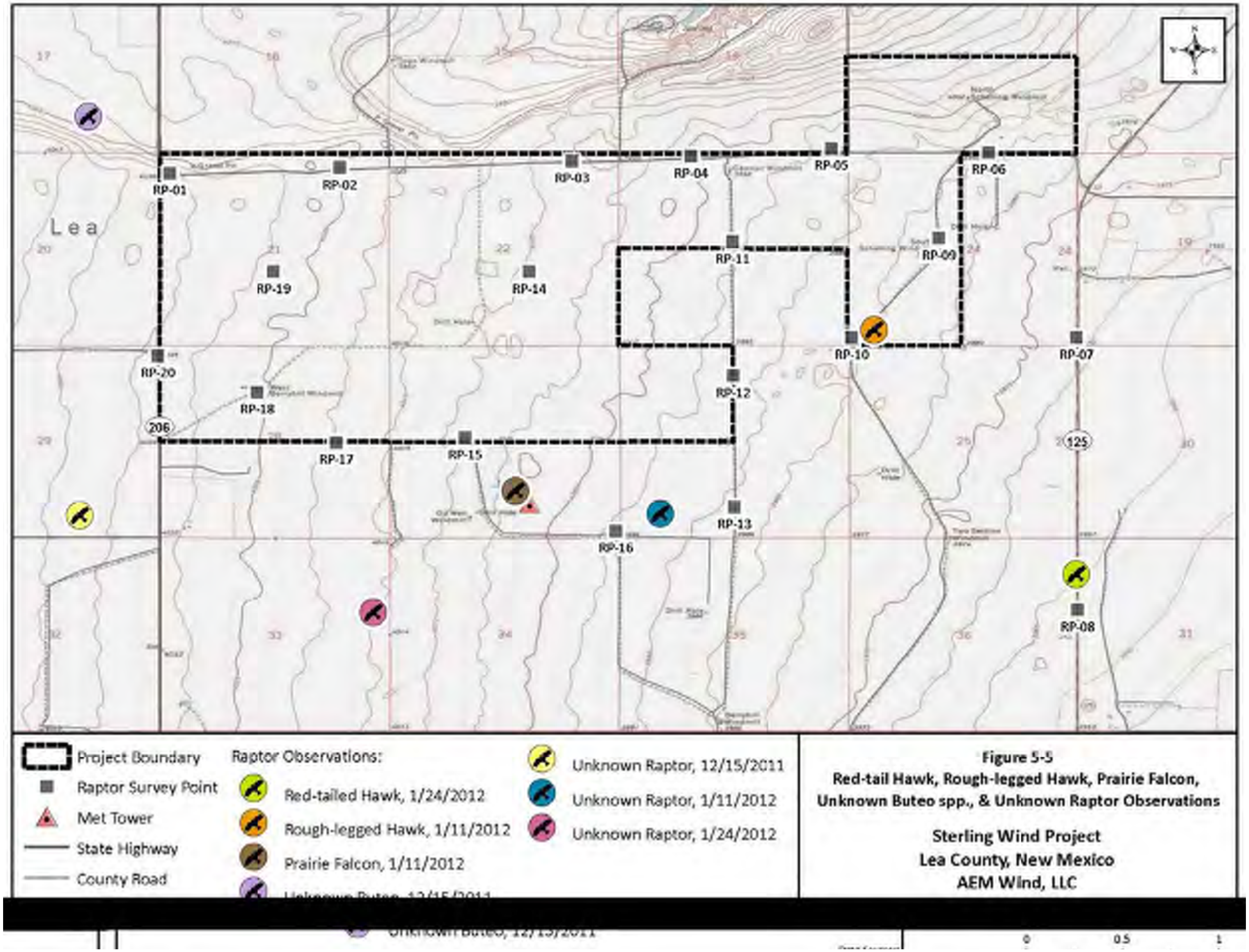

Figure 5-5 Red-tailed Hawk, Rough-legged Hawk, Prairie Falcon, Unknown Buteo Species, and Unknown Raptor Observations during the 2010-2011 Winter Raptor Study, Sterling Wind Project

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Table 5-1 Comparison of the Winter Raptor Results with Local CBC Count Results

	Clovis CBC[1]	Eunice-Lea CBC[2]	Greatest Single Day Number of Observed Individuals at the Project[3]
Northern Harrier (*Circus cyaneus*)	17	7	5
Sharp-shinned Hawk (*Accipiter striatus*)	1	1	0
Cooper's Hawk (*Accipiter cooperii*)	1	0	0
Harris's Hawk (*Parabuteo unicinctus*)	0	4	0
Red-tailed Hawk (*Buteo jamaicensis*)	15	10	1
Ferruginous Hawk (*Buteo regalis*)	17	0	6
Rough-legged Hawk (*Buteo lagopus*)	2	0	3
Golden Eagle (*Aquila chrysaetos*)	16	5	2
Merlin (*Falco columbarius*)	3	1	0
American Kestrel (*Falco sparverius*)	1	1	1

[1] Clovis CBC (2010-2011) had a 13-hour survey time
[2] Eunice-Lea CBC (2010-2011) had a 8.5-hour survey time
[3] The column lists the greatest number of observations of each species from one of the five surveys.

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APPENDIX C
STERLING WIND RETROFITTING PLAN

Distribution Line Retrofitting Plan for the Sterling Wind Project

Prepared for

AEM Wind LLC

Prepared by

SWCA Environmental Consultants

May 2017

DISTRIBUTION LINE RETROFITTING PLAN FOR THE STERLING WIND PROJECT

Prepared for

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SWCA Project No. 41601

May 2017

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1 INTRODUCTION AND PROJECT DESCRIPTION

Akuo Energy (AEM) is developing an approximately 30-megawatt (MW) wind project in Lea County, New Mexico. The project, consisting of 13 General Electric (GE) 2.3-116 turbines, will be constructed on private property approximately 8 km (5 miles) north of Tatum, New Mexico (Figure 1). The land has never been developed and is currently used exclusively as grazing land for beef cattle.

The natural shortgrass prairie vegetation for the region includes blue grama (*Bouteloua gracilis*), black grama (*B. eriopoda*), buffalograss (*B. dactyloides*), silver bluestem (*Bothriochloa saccharoides*), sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida* sp.), Arizona cottontop (*Digitaria californica*), hairy tridens (*Erioneuron pilosum*), muhly (*Muhlenbergia* sp.), bottlebrush squirreltail (*Elymus elymoides*), and sand sagebrush (*Artemisia filifolia*). Common shrubs include mesquite (*Prosopis* sp.), narrowleaf yucca (*Yucca angustissima*), juniper (*Juniperus* sp.), and ephedra (*Ephedra* sp.).

AEM submitted an eagle conservation plan (ECP) to the U.S. Fish and Wildlife Service (USFWS) in May 2016. The document concluded that although the project would not affect any nesting golden eagles, the birds did winter in southeastern New Mexico (SWCA Environmental Consultants [SWCA] 2016). Golden eagles were observed in the project area during avian point count surveys conducted by Ecosystem Management, Inc., from March 2009 to February 2010 (Ecosystem Management, Inc. 2010), and during winter raptor surveys conducted in 2010–2011 (Ecology and Environment, Inc. 2012).

Additional data from tagged juvenile golden eagles indicated use of the area south and west of the project in fall 2011 and fall/winter 2015–2016. During the 2015–2016 avian surveys, no golden eagles were observed in the original project area, but a juvenile golden eagle was regularly observed along U.S. Highway 380, 16 km (10 miles) west-southwest of the current project area.

Based on the avian point count data input to the Draft USFWS Collision Fatality Model Code, Version 3 (January 11, 2013), SWCA estimated one eagle fatality or fewer every 10 years. USFWS reviewed the ECP and provided comments in November 2016. A revised ECP was submitted to the USFWS in February 2017 using the agency's model run, which resulted in a similar fatality estimate.

Due to the potential for an eagle fatality, AEM considered the potential for applying for an eagle take permit, and the ECP proposed compensatory mitigation using the USFWS's resource equivalency analysis (REA) models for calculating appropriate golden eagle and bald eagle compensatory mitigation values for power pole retrofits (ECP Guidance [USFWS 2013]). Retrofits are also an effective and quantifiable compensatory mitigation measure and are still considered the most appropriate current option available to offset any fatalities that may occur as a result of operation of wind projects (USFWS 2016).

The REA models for power pole retrofits use currently available information on golden and bald eagle life history inputs, effectiveness of retrofitting lethal electric poles, and an estimated annual take to develop a framework for power pole retrofits as compensatory mitigation for golden and bald eagle fatalities. The REA models were used to determine the amount of compensatory mitigation needed by comparing eagle take (debit) with mitigation benefits (credits). The following assumptions were included in the analyses: 1) the power pole retrofits would occur prior to taking golden eagles, 2) the project life is 30 years, and 3) the life of the retrofits is 30 years and/or the retrofits will be maintained for 30 years. Under these assumptions, the REA analysis under a 5-year permit scenario (keeping all other assumptions consistent) indicated that 65 poles would need to be retrofitted for the anticipated level of one golden eagle take over the 5-year period to achieve the goal of no net loss of eagles.

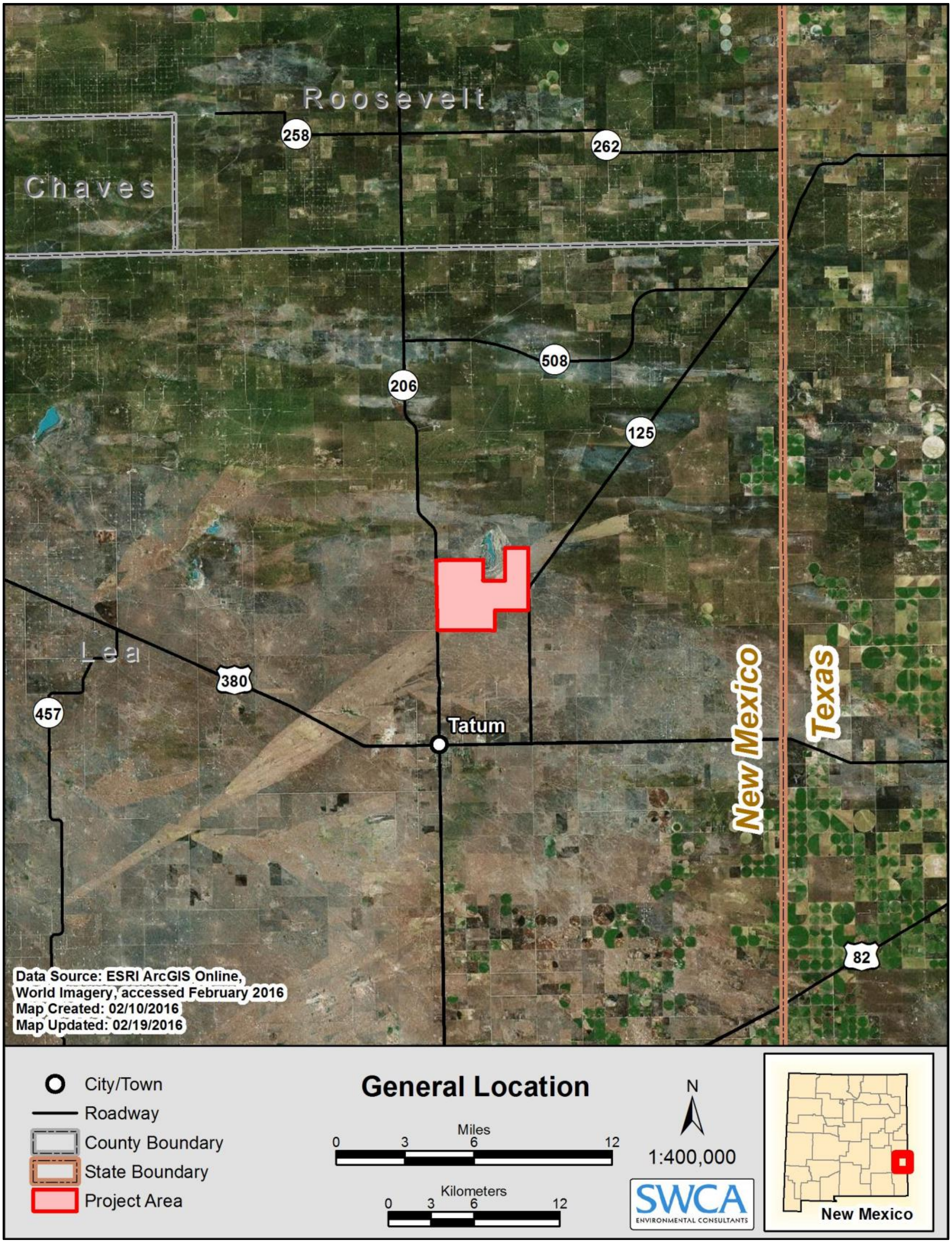

Figure 1. Sterling Wind project location map.

1.1 REGULATORY FRAMEWORK

1.1.1 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) specifically protects bald eagles and golden eagles. Under authority of the BGEPA (16 United States Code [USC] 668–668d), bald and golden eagles are afforded additional legal protection. The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, transport, export, or import, at any time or in any manner, of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof (16 USC 668). The act also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 USC 668c), and includes criminal and civil penalties for violating the statute (see 16 USC 668). The term "disturb" is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (50 Code of Federal Regulations [CFR] 22.3). On September 11, 2009, the USFWS established two new permit types under the BGEPA: 1) permits for take of bald and golden eagles that is associated with, but not the purpose of, the activity (50 CFR 22.26). To facilitate issuance of eagle take permits for wind energy facilities, the USFWS finalized the ECP Guidance (USFWS 2013). If eagles are at potential risk, developers are strongly encouraged to follow the recommended ECP Guidance for development of their projects. The ECP Guidance describes specific actions that are recommended to achieve compliance with the regulatory requirements in the BGEPA for an eagle take permit, as described in 50 CFR 22.26 and 22.27. The ECP Guidance provides a national framework for assessing and mitigating potential risk specific to eagles through development of ECPs and issuance of programmatic eagle take permits for eagles at wind energy facilities. AEM has developed this plan in consultation with the USFWS to avoid and minimize potential impacts to eagles and mitigate for unavoidable impacts.

2 METHODS

2.1 DISTRIBUTION LINE SURVEYS

SWCA obtained shapefiles and produced maps of the main distribution lines currently owned and managed by the Lea County Electric Cooperative (LCEC) (Figure 2). Surveys of these lines were conducted on January 26, 2017. Example transmission poles from each line were photographed and later evaluated for their potential risk for eagle electrocution using a risk assessment predictive model developed by EDM International Inc. (EDM) (2015). In addition, photos of the various lines were reviewed by Rick Harness, author of the EDM model.

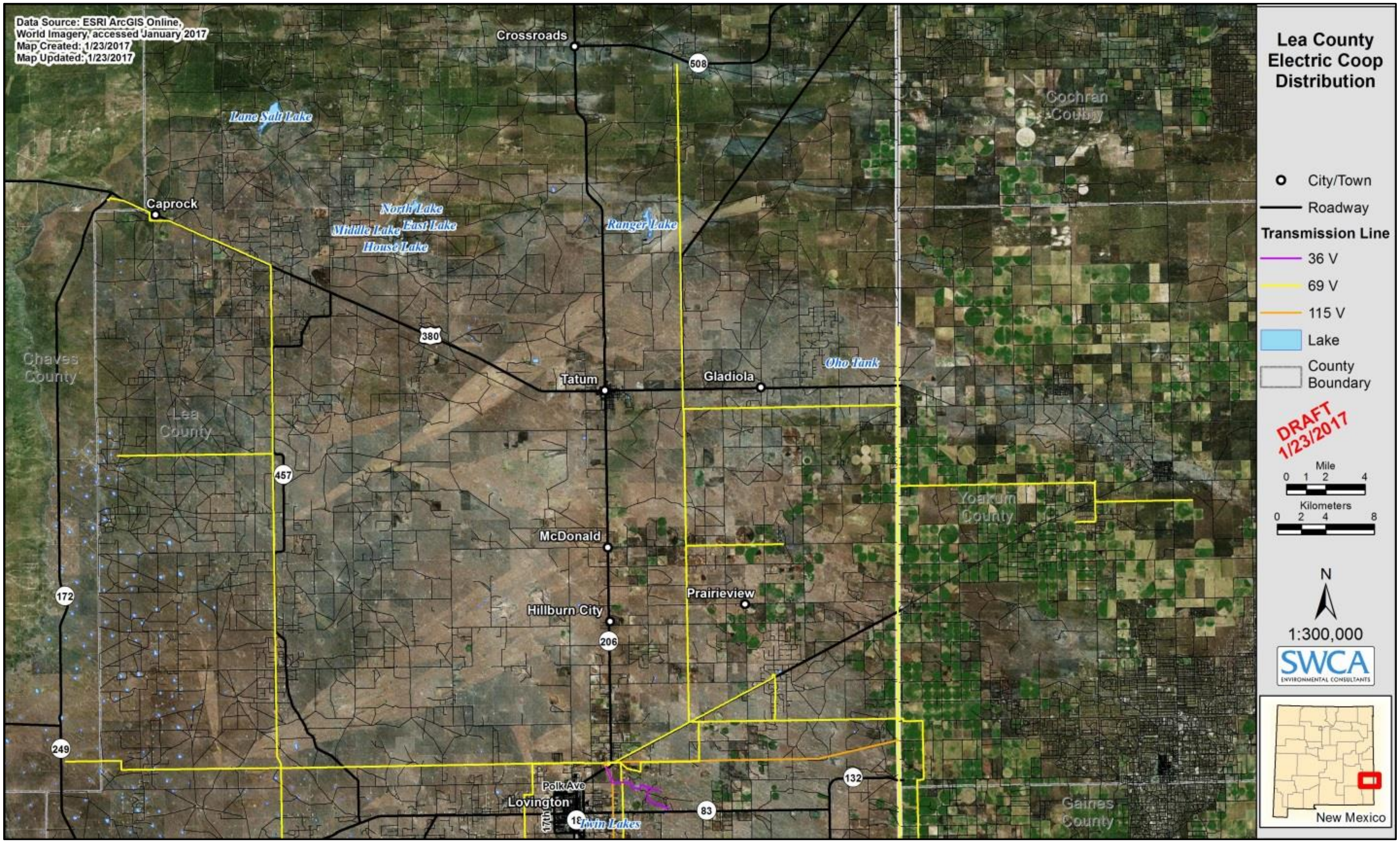

Figure 2. Locations of LCEC distribution lines near the project area.

3 RESULTS AND CONCLUSION

The risk assessment model predicts a range of electrocution probabilities based on the following factors: 1) quality of habitat, 2) number of primary conductors, 3) number of primary or equipment jumpers, and 4) addition of grounding. Poles located in high-quality habitat with several primary conductors, jumpers, and the presence of grounding have a higher risk or probability of an avian electrocution. Most of the distribution lines evaluated had low risk, i.e., where jumpers were well spaced and met or exceeded the 60-inch horizontal and 40-inch vertical clearance (Figure 3). Three-phase distribution lines had sufficient clearance or had ground wires below the insulators and were considered low to moderate risk (Figure 4).

The line estimated to have the greatest risk was represented by three-phase distribution lines, with uncapped jumpers and a ground wire running up the pole to the top that did not provide adequate horizontal or vertical clearance (Figure 5). This distribution line was evaluated to have both low- to high-quality habitat, the former occurring closer to the city of Lovington and near intense oil and gas development. However, a portion of the line west of Lovington extended through mostly undisturbed rangeland, where eagles might be expected to forage. Jackrabbits (Lepus sp.) and ground squirrel (*Ammospermophilus* sp.) burrows were observed along this section of the line when the line was surveyed on March 7, 2017, suggesting the presence of prey that would attract foraging eagles.

Distribution data from two tagged golden eagles suggested the birds used rangeland south and west of Tatum, across the Llano Estacado area, although they appeared to avoid agricultural areas directly south of the town. The portion of the line proposed for retrofitting runs roughly parallel and north of State Road 82 and occurs west of Lovington at the southern end of the Llano Estacado in an area relatively devoid of dense oil and gas development (Figure 6).

In addition to the risk posed by line structure, several poles with transformers were identified during a subsequent survey conducted on May 17, 2017. Despite their infrequent occurrence, studies have confirmed transformers are responsible for a large percentage of eagle and other raptor electrocutions (Avian Power Line Interaction Committee 2006). These three-phase transformer banks had multiple exposed jumpers, equipment bushings, cutouts and arrestors, which increase the potential for electrocution of eagles and other birds (Figure 7-**Error! Reference source not found.**).

Figure 3. Typical three-phase line near the project area with adequate horizontal and vertical clearance.

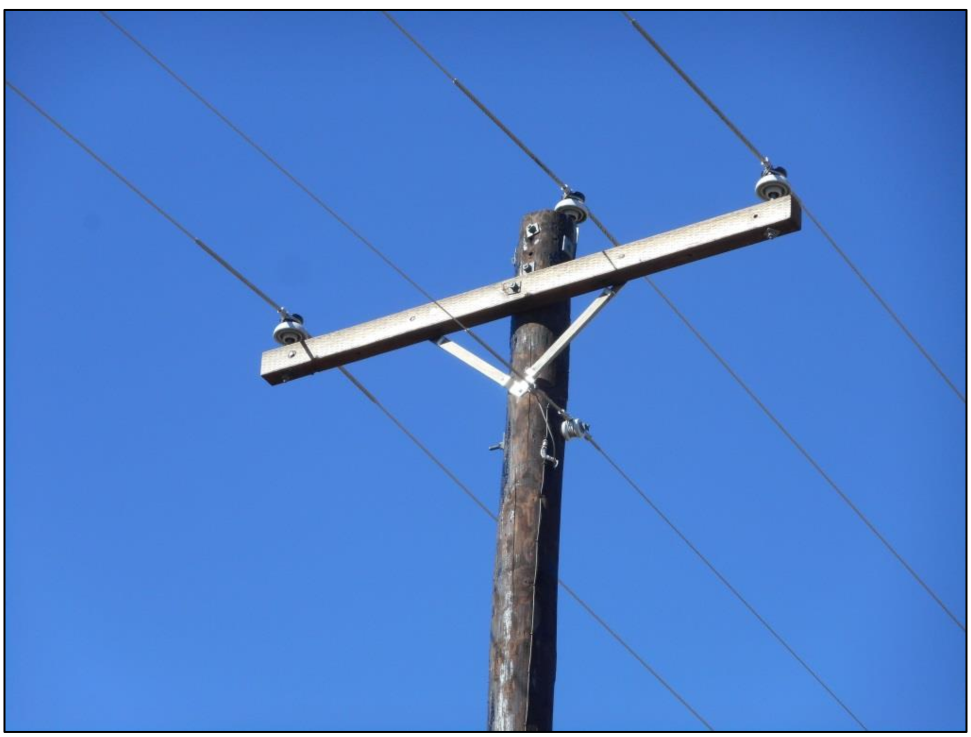

Figure 4. LCEC distribution line near the project area.

Figure 5. Jumper configuration of t-line selected for retrofitting.

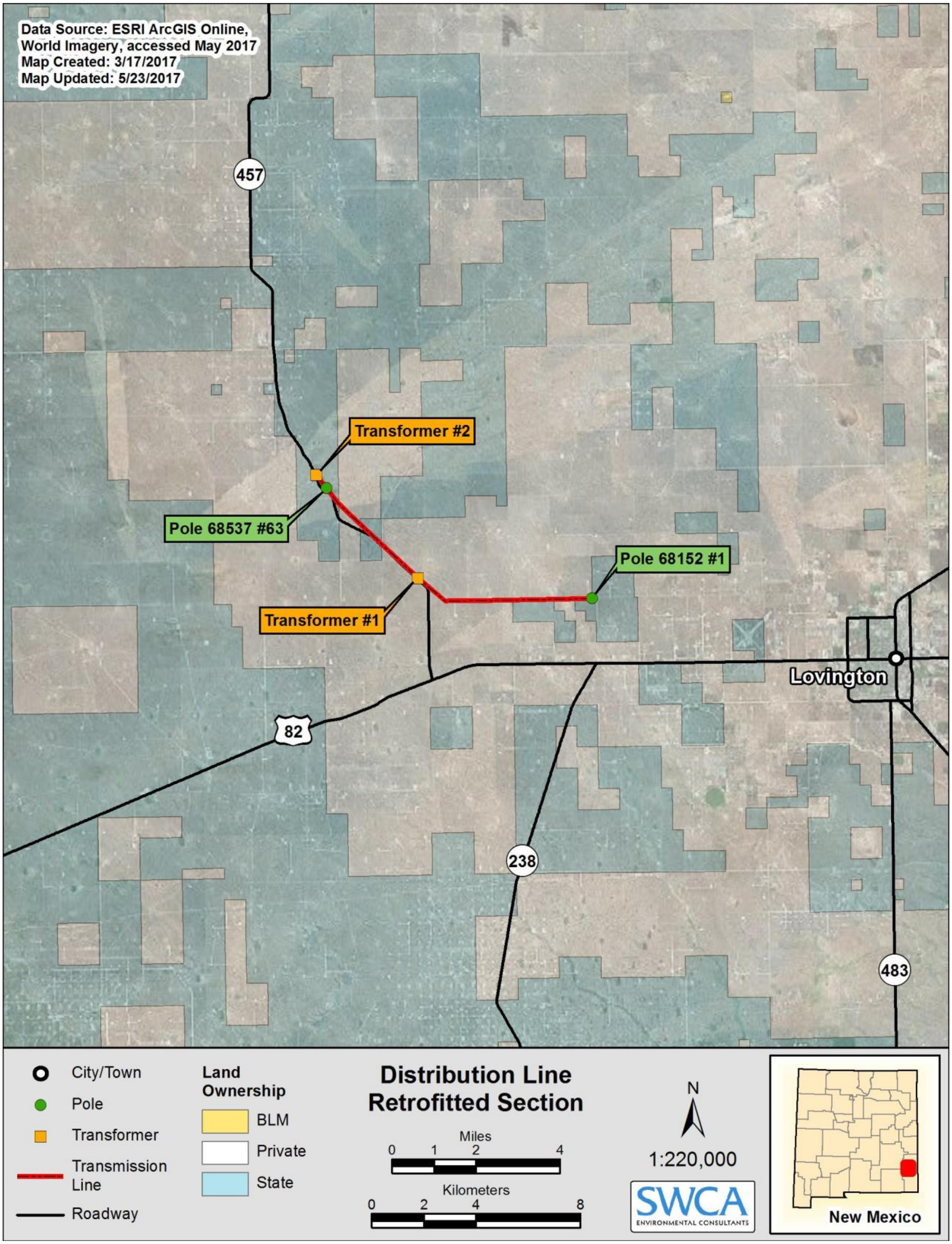

Figure 6. Location of distribution line segment proposed for retrofitting.

Figure 7. Three-phase transformer #1 proposed for retrofitting.

Figure 8. Single-phase transformer #2 proposed for retrofitting.

4 RECOMMENDATIONS

Sixty-three poles associated with distribution lines were selected for retrofitting. Following discussions with Robert Capps, Purchasing Agent, John Cartwright, Staking Technician, and Bobby Kimbro, Assistant Manager of LCEC staff, it was determined that use of a vertical line protector similar to one manufactured by Kaddas Enterprises, Inc. (part no. KE1162-03) would adequately cover the exposed jumpers (Figure 9). To prevent the covers from dislodging during high winds, they would be equipped with a locking mechanism.

Two covers would be employed. One cover would be used on the jumper situated on the right (facing north) arm where the two jumpers occur close together and pose a risk to large birds making contact with two energized phases of the line. The second cover would be used on the lone left jumper, which can pose a risk to eagles since the distance between it and the ground wire running up the left side of the pole is less than 60 inches. LCEC intends to inspect the lines annually and replace any missing covers. The inspections should take place in the late summer or early fall (August–September) each year prior to the time eagles begin to arrive.

For the three transformers, all energized jumpers, equipment bushings, cutouts and arrestors should be covered. If absent, bushing covers on the transformers should be employed. The grounding conductor should be covered from the highest energized phase to 12 inches (30.5 cm) below the lowest energized equipment (see additional info in APLIC 2006).

Figure 9. Example of line protector used to cover exposed jumper.

5 LITERATURE CITED

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APPENDIX D
SAMPLE TRIBAL CORRESPONDENCE LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE

P.O. Box 1306
Albuquerque, NM 87103-1306

In Reply Refer To:
FWS/R2/MB/069401

The Honorable Name
Title, Organization
Street Address
City, State, Zip code

Dear _____:

Pursuant to the National Historic Preservation Act of 1966, and the American Indian Religious Freedom Act of 1978, this will notify you of a Federal action proposed for private land in Lea County, New Mexico. The U.S. Fish and Wildlife (Service) is reviewing a permit application for the incidental take of golden eagles at the Sterling Wind Project, approximately 5 miles north of Tatum, NM. The enclosed handout will provide you with an overview of the wind facility and the history of the application process. We are requesting your views, comments, or concerns regarding the proposed permit authorizing incidental take of bald eagles at the Sterling Wind Project.

As provided under the National Historic Preservation Act, the Service has determined that eagles are species of cultural and spiritual significance to many Indian Tribes, and that eagles can be contributing elements of traditional religious and cultural importance to Native American Tribes. The Service has further determined that disturbance of eagles can affect the free exercise of American Indian religious practices, as provided under the American Indian Religious Freedom Act.

The Service looks forward to working with you to promote the conservation of all eagles while ensuring the protection of tribal trust resources, rights, and cultural and religious values. Although there is no mandatory time limit for your response, we are requesting your reply within 45 days, so that we may further advise the permit applicant and proceed with our evaluation of the permit application.

Please contact Joe Early, Native American Liaison at 505-248-6602 or joe_early@fws.gov to arrange a meeting on these topics or to submit your comments to Kammie Kruse, Wildlife Biologist at 505-248-6875 or kammie_kruse@fws.gov. Thank you for your review and consideration.

Sincerely,

Regional Director

Enclosure