Appendix D-30

Draft #2 Eagle Conservation Plan
March 2012

Draft No. 2

Conservation Plan for the Avoidance and Minimization of Potential Impacts to Golden Eagles

Alta East Wind Project

Submitted to

Bureau of Land Management

U.S. Fish and Wildlife Service

Submitted by

Alta Windpower Development, LLC

March 2012

Prepared by

CH2MHILL®

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Acronyms and Abbreviations

ACP	advanced conservation practice
AOCM	Alta Oak Creek Mojave
APLIC	Avian Power Line Interaction Committee
APP	avian protection plan
AWD	Alta Windpower Development, LLC
BGEPA	Bald and Golden Eagle Protection Act
BLM	U.S. Bureau of Land Management
BMP	best management practices
CEC	California Energy Commission
CFR	Code of Federal Regulations
ECP	Eagle Conservation Plan
IM	BLM Instructional Memorandum 2010-156
MW	megawatt(s)
NEPA	National Environmental Policy Act
ROW	right-of-way
SR	State Route
USFWS	U.S. Fish and Wildlife Service
WTG	wind turbine generator

SECTION 1.0

Introduction

Alta Windpower Development, LLC (AWD) proposes to construct the Alta East Wind Project (project) in the Tehachapi region of southern California. Portions of the project would be located on land managed by the U.S. Bureau of Land Management (BLM) and privately owned land under the jurisdiction of Kern County.

1.1 Project Description

The project is proposed to be located on approximately 3,195 acres on the northern and southern sides of State Route (SR) 58 in southeastern Kern County, California, within and adjacent to an area of existing wind development. The project area is approximately 3 miles northwest of the town of Mojave and approximately 11 miles east of the city of Tehachapi.

The proposed development is a wind energy facility with a nameplate capacity rating of approximately 300 megawatts (MW) of wind turbine generation and includes ancillary facilities and supporting infrastructure. Up to 120 wind turbine generators (WTG) would be installed. The project site includes private and federal lands. Federal lands within the project area are under BLM jurisdiction, and private lands are under the jurisdiction of Kern County. Approximately 30 percent of the project's area (1,115 acres) and approximately 33 percent of the WTGs would be located on land managed by Kern County. The location of the project site is shown on Figure 1, Project Area Map.

1.2 Background

BLM is the lead agency for review under the National Environmental Policy Act (NEPA). The U.S. Fish and Wildlife Service (USFWS) is a participating agency as it relates to their involvement in Section 7 consultation under the federal Endangered Species Act and the BLM Instructional Memorandum (IM) 2010-156 (hereafter referred to as the IM) issued in July 2010. The purpose of the IM is to provide direction for complying with the Bald and Golden Eagle Protection Act (BGEPA), including its implementing regulations for golden eagles (i.e., September 11, 2009, Eagle Rule 50, Code of Federal Regulations (CFR) parts 13 and 22), and to identify steps that may be necessary within the habitat of golden eagles to ensure environmentally responsible authorization and development of renewable energy resources. The IM is applicable until USFWS establishes criteria for programmatic golden eagle permits.

1.3 Purpose of the Conservation Plan

The project may have the potential to affect golden eagles or their habitat. Therefore conservation measures in the form of an Eagle Conservation Plan (ECP) have been prepared to avoid and minimize project impacts on golden eagles. This ECP for the avoidance and minimization of potential impacts on golden eagles has been developed by AWD to meet

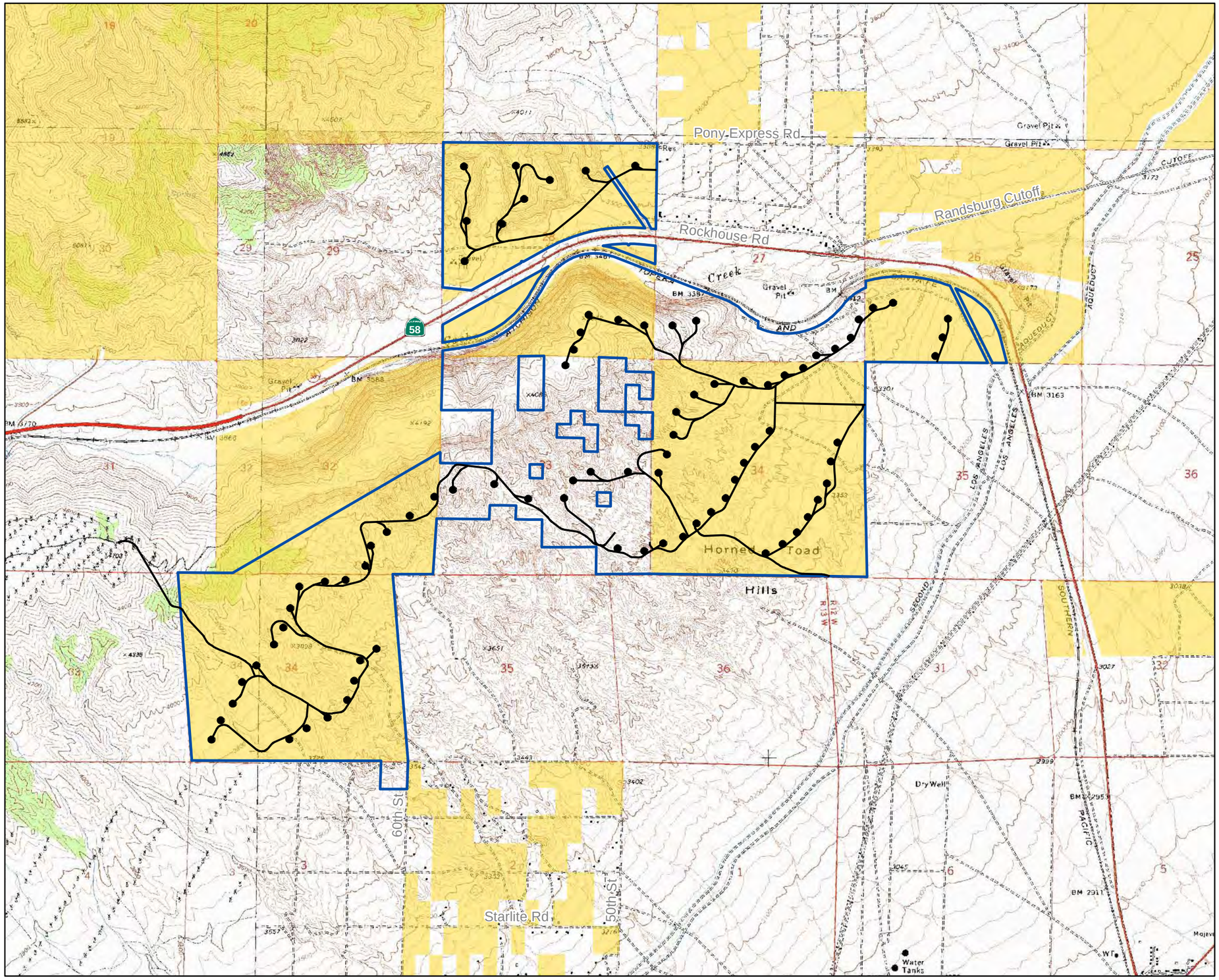
the requirement for an Avian Protection Plan (APP) according to the IM, and more recently detailed in the *Draft Eagle Conservation Plan Guidance* (USFWS, 2011). The ECP has been developed in coordination with USFWS and BLM, to evaluate options to avoid and minimize project impacts and address siting, operations, and monitoring. In accordance with the IM, a letter of concurrence from USFWS that addresses the adequacy of the plan is provided in Appendix A of this report (to be provided when received).

Additionally, this ECP has been developed to meet BLM and USFWS requirements for addressing the BGEPA. The BGEPA prohibits take of eagles, which is defined as any action to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, disturb, or otherwise harm eagles, their nests, or their eggs. The BGEPA defines "disturb" as to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle; (2) decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. The USFWS set in place rules establishing two new permit types: (1) incidental take of bald and golden eagles, which is associated with an activity but not the purpose of the activity; and 2) purposeful take of eagle nests that pose a threat to human or eagle safety (September 11, 2009; Federal Register, 50 CFR 13 and 22).

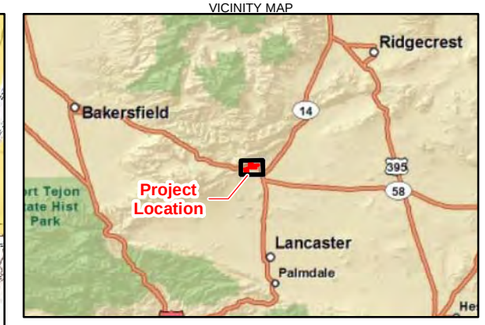
1.4 Interagency Coordination and Communication History

April 29, 2010	AWD provided USFWS with the biological resources study plan for review and input.
November 29, 2010	Representatives from AWD met with Ashleigh Blackford and Danielle Dillard of USFWS and Justin Sloan of the California Department of Fish and Game. Jacqui Kitchen of the Kern County Planning Department participated via telephone. The project was introduced and the results of baseline wildlife studies completed to date were presented.
November 30, 2010	AWD received correspondence from USFWS regarding the baseline study plan presented to USFWS in April 2010.
December 10, 2010	AWD responded to correspondence from USFWS regarding the baseline study plan
March 22, 2011	Draft ECP was submitted to USFWS.
September 26, 2011	Comments on Draft ECP received from the USFWS.
March 8, 2012:	Revised Document provided to USFWS for final review.

Future agency coordination and communication will be documented.



VICINITY MAP



LEGEND

- Proposed Wind Turbine Layout
- Proposed Access Road
- BLM Lands
- Alta East Wind Project Area

N

0 1,100 2,200
Feet

FIGURE 1
Project Area Map
Alta East Wind Project
Alta Wind Energy Center Project

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SECTION 2.0

Eagle Conservation Plan Development

2.1 Stage 1 – Initial Site Assessment

In July 2009, AWD completed an initial site assessment to evaluate potential constraints or risks related to the project and its impacts to golden eagles. The Tehachapi area was specifically selected for evaluation because of the extensive existing wind energy development in the region, the expected low level of avian impacts associated with the operating projects, the lack of critical habitat for federally endangered species, and the apparently manageable issues related to other special-status species potentially present on site. Based on pre-field review of publicly available resources (California Natural Diversity Database [CDFG, 2009], California Native Plant Society database [2009], BLM special-status species management manual [BLM, 2001], and the California Desert Conservation Area Plan [BLM, 1999]), as well as reconnaissance surveys conducted at the site between 2006 and 2009 and during a March 19, 2009, site visit specifically designed to evaluate potential resource issues, it was determined that the site presented low levels of risk for biological resource issues, including eagles, and that investment in site-specific resource studies was warranted to evaluate the extent of golden eagle use and potential impacts to the species. Application of the procedural questions for ranking the project's risk level reveals that this project site possesses few risk factors and would pose minimal risk to eagles and is therefore a candidate for being a Category 3 site, based on the fact that the area was determined not likely to support important eagle-use areas.

2.2 Stage 2 – Site-specific Surveys and Assessment

In accordance with the IM, and consistent with the Stage 2 recommendations for site-specific surveys and assessment presented in the draft ECP guidance, AWD has considered golden eagles and their habitat in its baseline characterization studies of the project area. AWD applied the *Interim Golden Eagle Inventory and Monitoring Protocols and other Recommendations* (Pagel et al., 2010) and additional onsite studies of eagle use, completed in accordance with *The California Guidelines for Reducing Impacts to Birds and Bats from Wind Energy Development* (California Energy Commission [CEC], 2007), to evaluate eagle use on the project. Additionally, AWD submitted its baseline study plan to USFWS for review and input in April 2010, and comments were received November 30, 2010.

Baseline eagle studies completed to date for the project include 30-minute point counts conducted at approximately 1-week intervals throughout the area proposed for development, from May 2009 through February 2011. In addition, helicopter surveys were completed in April and May 2010, and February 2011, to identify potential eagle nesting territories within 10 miles of the project area. The analysis area was determined in accordance with the USFWS Interim Inventory and Monitoring Protocols available for golden eagles. Onsite surveys to document the extent of eagle use are planned to continue at least through May 2011, and additional helicopter surveys will be completed in spring 2011

to monitor previously identified nesting territories and identify new or previously undiscovered territories, if present. Future eagle surveys will be completed in accordance with USFWS 2010 Inventory and Monitoring Protocol recommendations (Pagel et al., 2010) as requested by USFWS in the November 29, 2010 meeting. Site-specific survey methods and results are summarized below, and complete avian reports that include detailed discussion of methods and results are presented in Chatfield et al. (2010a, b, and c).

2.2.1 Avian Point Count Surveys

The objective of the fixed-point bird use surveys was to estimate the seasonal and spatial use of the study area by birds, particularly diurnal raptors, which include golden eagles. Fixed-point surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). All birds, with a focus on raptors and large birds, seen during each 30-minute fixed-point survey were recorded. These surveys are standard assessment techniques used to assess most wind energy projects in California and are completed in accordance with CEC guidelines (CEC, 2007).

Six points were selected to survey representative habitats and topography, while providing relatively even coverage of the area that was proposed for development in May 2009 (Figure 2). For the purposes of golden eagle assessment, a viewshed of 800 meters around each point was assessed. If eagles were observed, flight paths were mapped across the survey point. The project boundary was modified to include additional area in June 2010, so the locations of three of the six avian use survey points were modified to more specifically assess the area anticipated for project development (Figure 3). Avian survey point 4 was moved approximately 0.5 miles south to allow the assessment viewshed to encompass the entire parcel located north of Highway 58. Points 5 and 6 were moved south of the highway, Point 5 approximately 0.5 mile south and Point 6 approximately 2 miles southeast, to enable full assessment of eagle use along the ridge located south of Highway 58 and of the southwestern portion of the new project area. These points were evaluated for one year during the second year of the study. The effect of relocating these avian survey points preclude direct comparison of mean use from year 1 to year 2 for these three points; however, the relocation substantially enhances the ability to understand eagle use of the area planned for WTG installation, and thus enables more comprehensive assessment of the potential risk that the project, as proposed, would pose to golden eagles using the project area.

A total of 311 30-minute fixed-point bird use surveys were conducted during 52 site visits, from May 2009 through May 2010. A total of 7 golden eagle groups with 11 individual sightings were recorded during this sampling effort. However, all observations occurred off the project area at survey points 4, 5, and 6 Figure 4). Observations were recorded during all seasons (spring, n=1 eagle; summer, n= 1; fall, n= 3; winter, n= 6) and suggested potentially higher use of these off site areas in winter (Table 1). Except in the case of one fall sighting of two separate birds and three winter sightings of two separate birds, it cannot be determined from the data collected if these are repeat sightings of the same birds or individual sightings of unique birds.

The eagle use documented in the May 2009 to May 2010 studies is potentially explained by the existence of eagle nesting territories north and west of the project as described in Section 2.2.2, Nesting Territory Surveys. During the survey period, all eagle use was off the

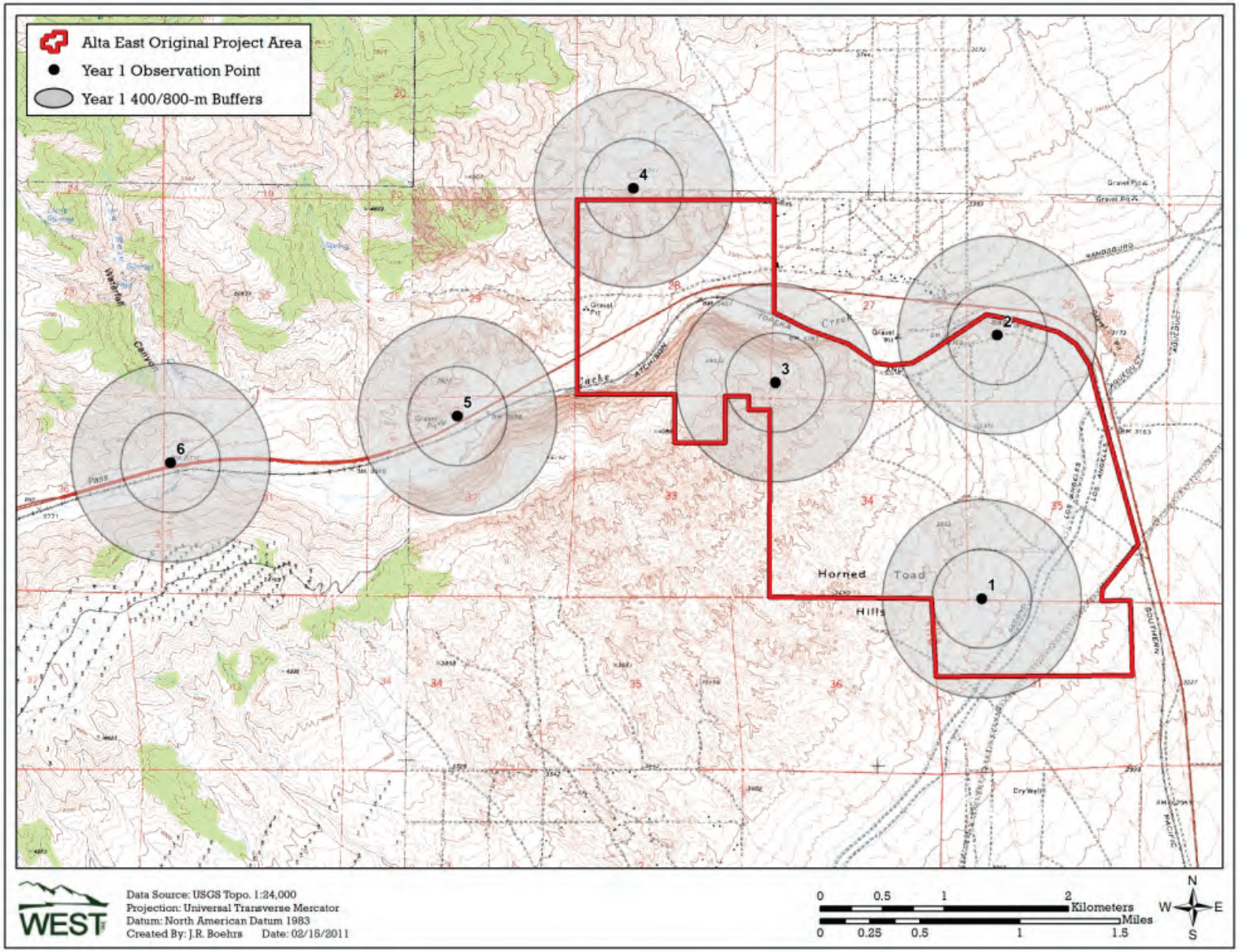

FIGURE 2
Alta East Project Boundary and Avian Use Survey Points from May 11, 2009 to May 6, 2010

Alta East Wind Project
Alta Wind Energy Center Project

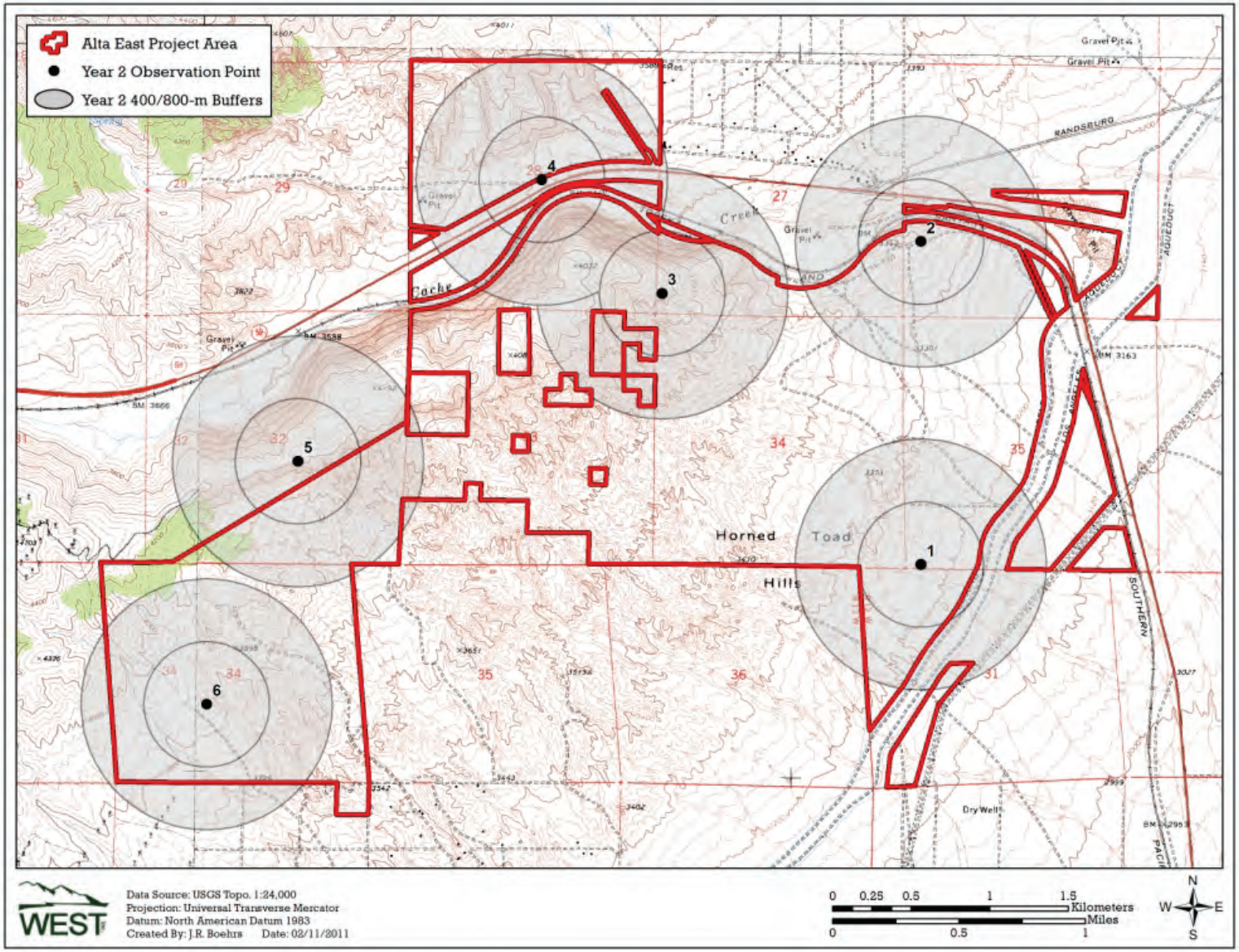

FIGURE 3
Alta East Project Boundary and Avian Use Survey Points from July 10, 2010 to June 1, 2011
Alta East Wind Project
Alta Wind Energy Center Project

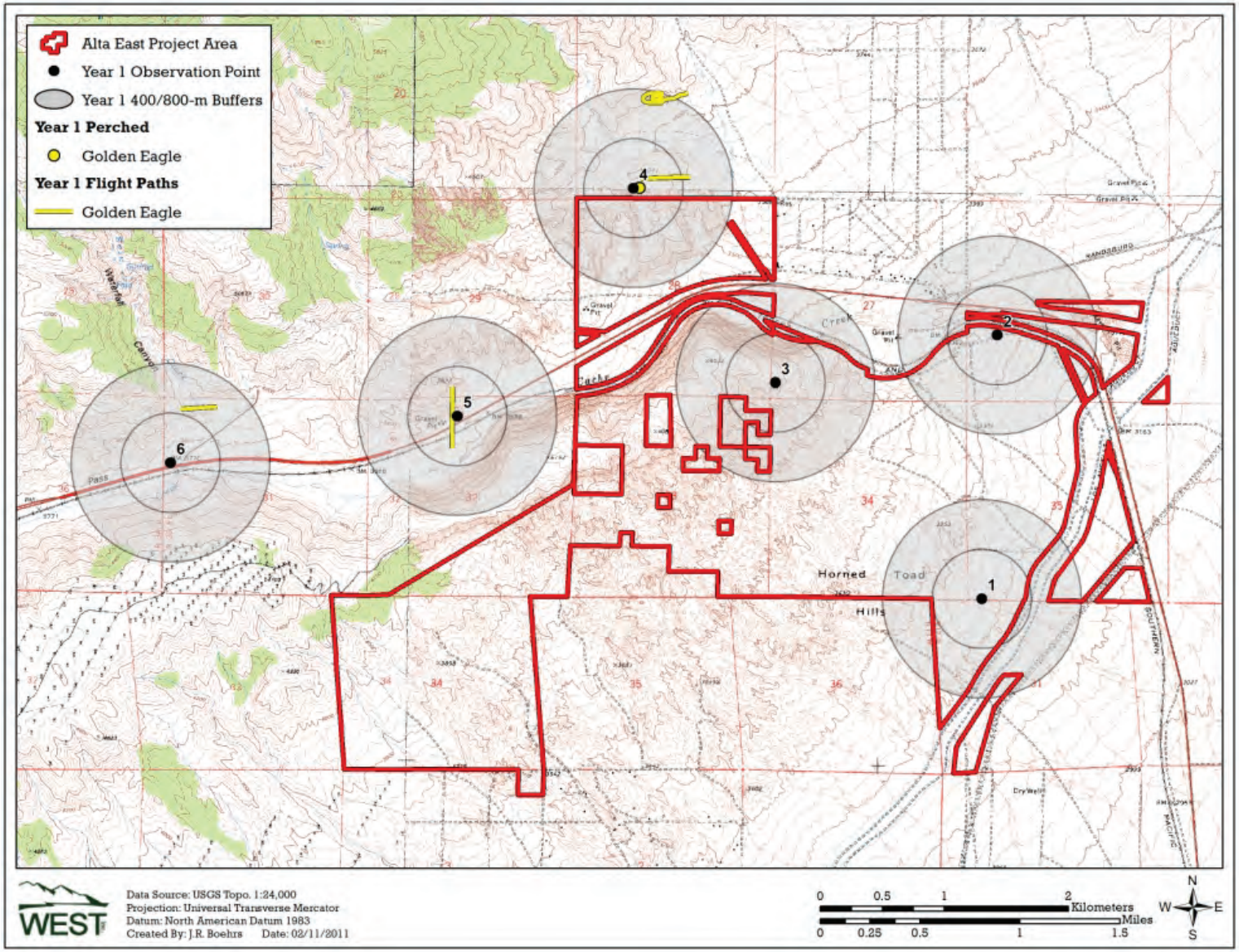

FIGURE 4
Golden Eagle Flightpaths from May 11, 2009 to May 6, 2010
Alta East Wind Project
Alta Wind Energy Center Project

TABLE 1
Golden Eagle Group and Individual Observations, May 11, 2009 to May 6, 2010
Alta East Wind Project

Season	No. of Groups Observed	No. of Individuals Observed
Spring	1	1
Summer	1	1
Fall	2	3
Winter	3	6
Total	**7**	**11**

project site, away from areas proposed for project development, and associated with higher elevation and rugged topography north and west of the project. When the offsite survey location data for this period are pooled with the avian survey locations from points located within the current project area, mean use by eagles (number of individuals observed per 800-meter plot per 30-minute survey) ranges from 0.01 eagle in spring to 0.07 eagle in winter. In other words, the frequency with which eagles were detected using the area north and west of the project was very low, and if use occurred on the project, it was too infrequent to detect with the standard probabilistic sampling regime.

A total of 260 30-minute fixed-point bird use surveys were conducted during 47 site visits, from July 10, 2010 through June 1, 2011 at the six avian use points evaluated during year 2. No eagle observations were recorded during studies conducted from July 10, 2010 through September 2010, when surveys were focused more specifically on the project area as currently proposed for development (see Figure 3). However, seven golden eagle groups consisting of eight eagle observations were recorded from October 10, 2010 through March 10, 2011 (Table 2: Figure 5). These observations were associated with the escarpment edge running east-west along the northern portion of the project, concentrated around survey points 3 and 4, with one occurring at point 5. It is evident from these data that at least three separate individuals were recorded; however, it cannot be determined whether these detections were of unique nomadic individuals or repeat observations of local/resident birds. Assuming each bird recorded was a unique individual, a total of eight different eagles may have been detected using the project area during fall 2010 and winter 2010-11. All eight of these fall and winter observations were of flying eagles, indicating movement through the project area and possible foraging. No perching eagles, or those actually feeding on prey items, have been recorded within or near the project boundary.

The eagle use documented in the fall and winter of the year 2 study is potentially explained by seasonal or annual variation in the use of the project area by eagles. No strong association with topography is evident from these data that would indicate a specific high risk area warranting siting consideration during project planning. Golden eagle mean use was 0.0 birds/30 minute count during spring and summer, 0.02 birds/30 minute count in fall, and 0.08 birds/30 minute count in winter and golden eagles comprised less than 2 percent of all birds observed during any of the four seasons evaluated. In other words, the frequency with which eagles were detected using the project area in year 2 studies was very low.

TABLE 2
Eagle Observations from October 7, 2010 through June 1, 2011
Alta East Wind Project

Date	Point	Age	# Individuals	Height Above Ground (meters)		Activity
				Highest	Lowest	
10/7/2010	3	Adult	1	400	200	Soaring
11/30/2010	3	Juvenile	1	110	40	Gliding
12/7/2010	1	Unknown	1	45	25	Gliding
1/20/2011	3	Adult	1	85	20	Soaring
2/17/2011	4	Juvenile	2	125	40	Circle Soaring
2/25/2011	3	Unknown	1	40	40	Gliding
2/25/2011	6	Unknown	1	40	25	Gliding

2.2.2 Nesting Territory Surveys

Aerial eagle nest surveys were conducted via helicopter on April 13 and May 24, 2010 at the project area and again in February and April, 2011. The objective of the surveys was to locate nests that may be subject to disturbance or displacement effects from project construction or operation. While active and inactive nests of all raptor species were recorded, the survey specifically targeted golden eagles and was consistent with the USFWS Guidelines (Pagel et al., 2010). The survey area for golden eagle nests included all eagle nesting habitat within a 10-mile radius of the project.

No active eagle nests were located within the project boundary in 2010 (Figure 6). One active golden eagle nest was observed on a cliff ledge approximately 3.1 miles from the northwestern boundary of the project area. Two nestlings were observed in this nest on May 24, 2010. A second active golden eagle nest was observed in a live gray pine (*Pinus sabineana*) approximately 11.0 miles west of the project. One adult was observed on this nest on April 13, 2010, and two adults were observed perched in the nest vicinity on May 24, 2010. Single adult golden eagles were observed perched at two additional locations within the survey area, approximately 7.0 miles northeast and approximately 7.5 miles south of the project area. Additionally, nine inactive nests that could have potentially been constructed by golden eagles were documented within the survey area.

No active eagle nests were located within the project boundary in 2011. One aerial eagle nest survey was conducted in late February 2011 for area within 10 miles of the project. The nests identified in the 2010 surveys were present; however, no eagles were observed and the nests were determined inactive at this time. Eight additional inactive nests of varying condition were documented in the 2011 survey that may have been initially constructed or historically utilized by golden eagles. A second survey was completed in April 2011 and three active golden eagle nests were identified within 10 miles of the project (Figure 7). These nests were 3.0 miles northwest, 3.8 miles north, and 6.8 miles north of the project. The northwestern nest was confirmed o have failed and the two northernmost nests were confirmed active on

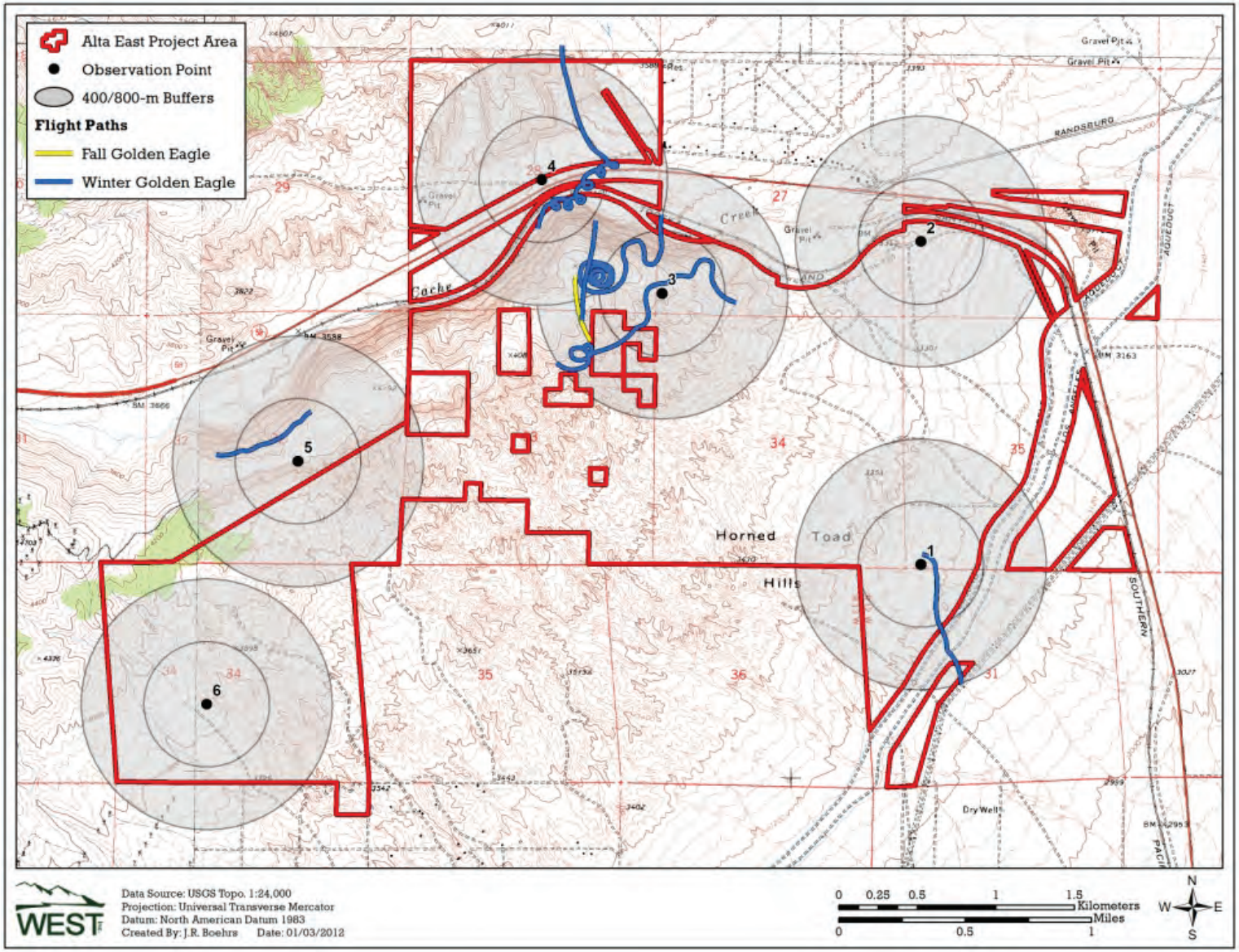

FIGURE 5
Golden Eagle Flightpaths from July 10, 2010 to June 1, 2011
Alta East Wind Project
Alta Wind Energy Center Project

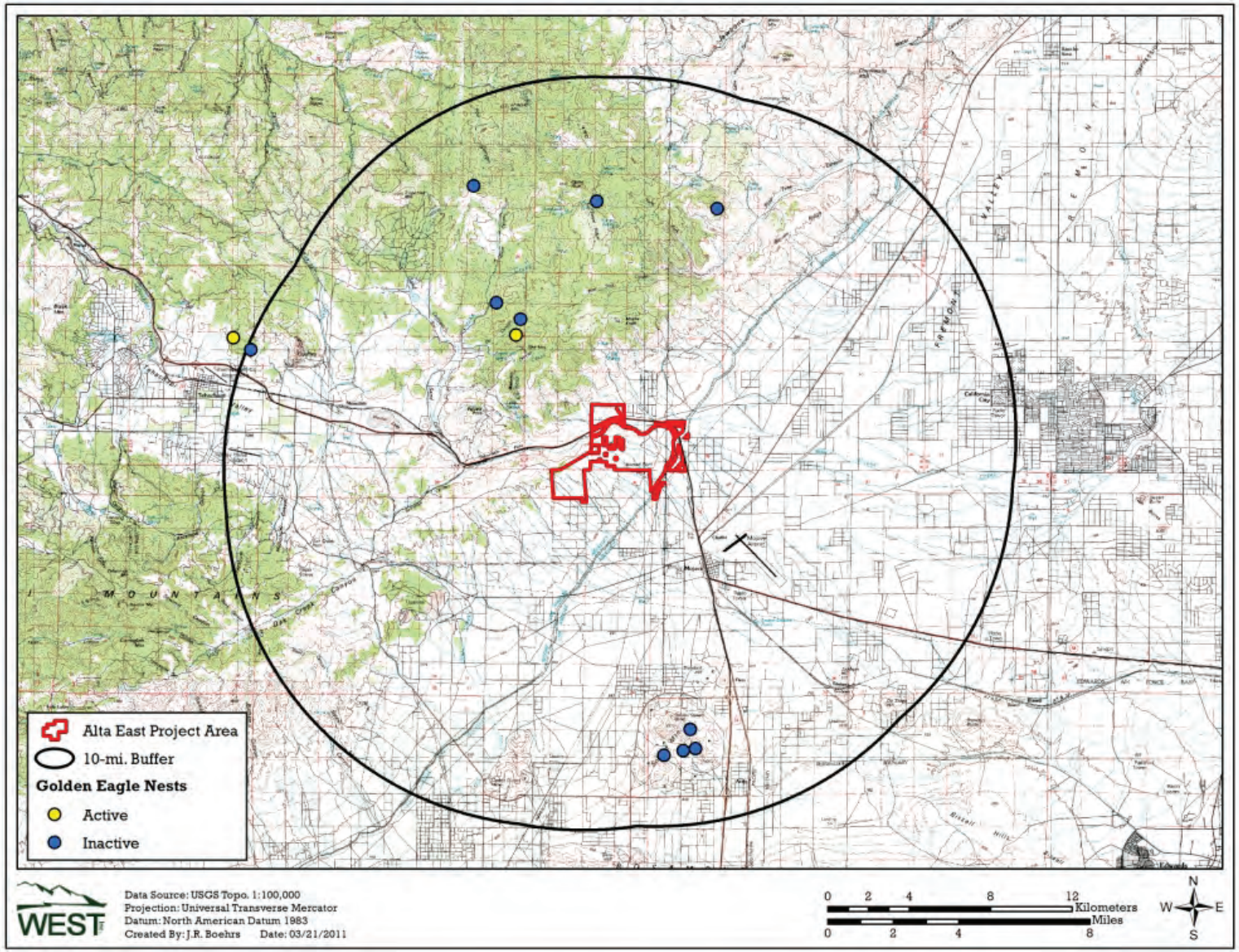

FIGURE 6
Golden Eagle Nesting Territory Survey Results, April 13, 2010 and May 24, 2010
Alta East Wind Project
Alta Wind Energy Center Project

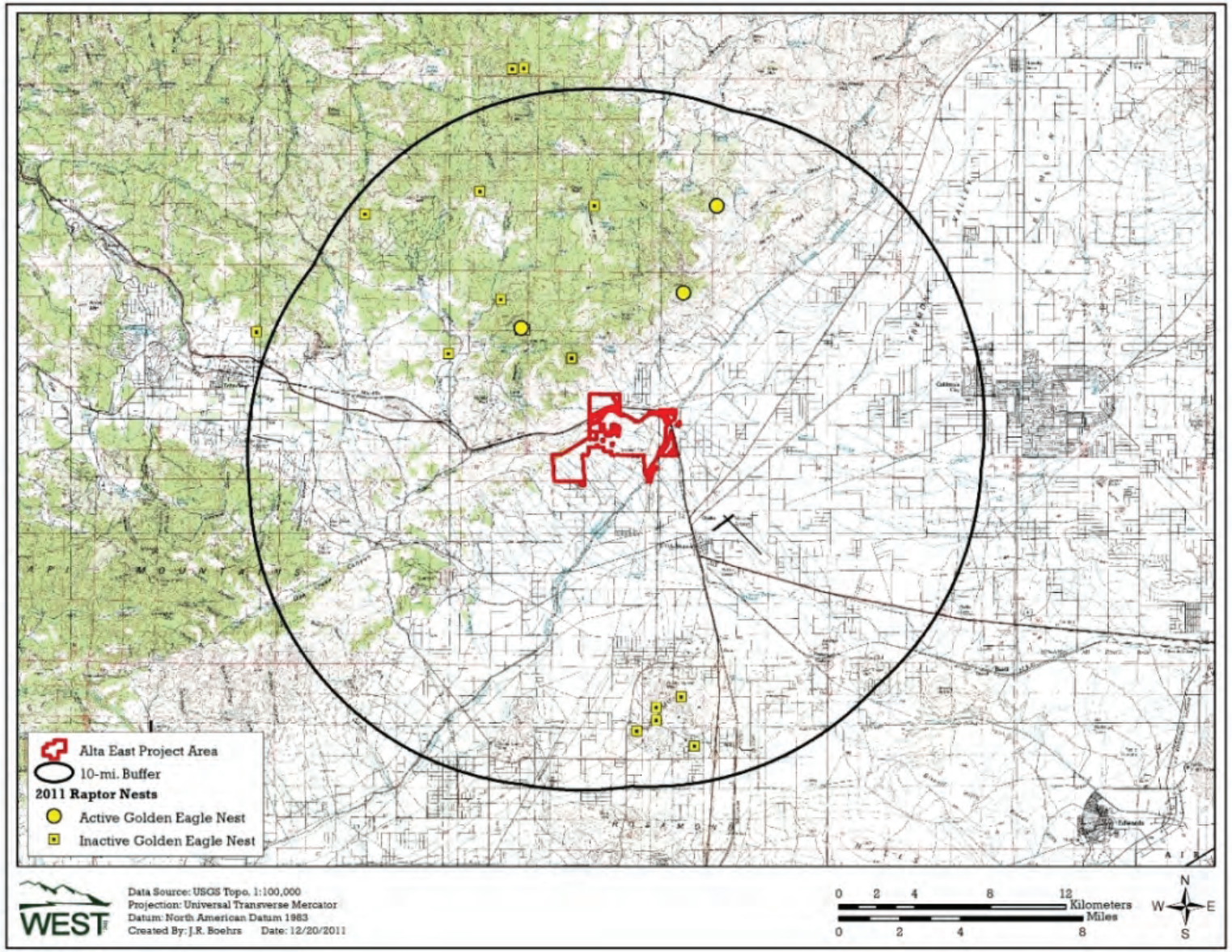

FIGURE 7
Golden Eagle Nesting Territory Survey Results, February and April, 2011
Alta East Wind Project
Alta Wind Energy Center Project

a follow-up survey completed on June 1, in which two young were observed in the nest 6.8 miles north and one was observed in the nest 3.8 miles north. The young were estimated to be between 7 to 8 weeks old. The persistence of these nesting territories in light of such substantial wind energy development in the Tehachapi area suggests that the likelihood of take and/or territory loss would be low in response to the proposed project.

2.2.3 Assessment of Nonbreeding Habitat

According to the National Land Cover Database (U.S. Geological Survey, 2001), the dominant cover type within the project area is scrub-shrub, which constitutes 96.7 percent of the study area. Grasslands and low-intensity developed areas are 1.3 percent and 1.0 percent of the study area, respectively. The remaining land cover types, developed open space, evergreen forest, and barren land constitute just over 1 percent of the project, combined.

Studies in California indicate that golden eagles select grasslands and oak savanna, with fewer eagles selecting oak woodland and open shrublands (Hunt et al., 1998). The Hunt et al. study is of the Altamont Pass wind resource area and was completed in response to USFWS concern that fatalities might adversely affect the golden eagle population in the region. It was not specifically a food/habitat selection study, but documents some of the highest nest densities in California and thus the habitat described indicates fairly optimal conditions. Alta East differs from this wind resource area in that it has few perches and potentially low small mammal and prey resource densities. Selection seems to depend on the availability of prey. Primary prey species for golden eagles are rabbit, hare, and rodents, but golden eagles also take other mammals, birds, reptiles, and scavenge a limited amount of carrion (Olendorff, 1976). California ground squirrels (*Spermophilus beecheyii*) and black-tailed jackrabbits (*Lepus californicus*) are the among the most important prey species for the golden eagle (Hunt et al., 1998). Eagles generally hunt prey from favored perches near regular updrafts, which allow soaring to heights sufficient for them to efficiently scan their hunting areas (Johnsgard, 1990). Although project prey studies were not done, the project area generally consists of habitats typically not selected by golden eagles. Additionally, no prominent or used perches were detected after careful evaluation of the project area.

A potential indicator of the importance of habitat in a particular area to golden eagles is the extent of use relative to other areas on the landscape. Data collected to evaluate this project area indicate that during the first 12-month period of evaluation, eagle use within the project area was distinctly different from the area observed to the north and west, where eagle use was documented. Of the 7 golden eagle groups (n = 11 birds) observed during the year 1 study, all were north and west of the area proposed for development and off the project area at survey points 4, 5, and 6. Observations were recorded during all seasons (spring, n=1 eagle; summer, n= 1; fall, n= 3; winter, n= 6) and suggested potentially higher use of these off site areas in winter (see Table 1) because no eagles were recorded at the survey points 1, 2, and 3 located onsite. This difference in eagle use could be associated with lower quality foraging habitat, lack of perch sites or foraging opportunities, less desirable thermal or wind characteristics, or by general land use activity differences that make the project area less attractive to eagles than the surrounding landscape. This difference in eagle use is measurable in the data collected during this period suggests that the project is well-sited with regard to minimizing risk of collision for eagles.

Although eight eagles were documented on the project site from October 7, 2010 to February 25, 2011, the seasonality of eagle use of the area proposed for WTGs indicate that this use is not associated with the nesting period. No use was recorded between February 25, 2012 and June 1, 2012, and no nests were recorded as active during the February 22, 2011 nest survey. While the winter observations may have included eagles from these nesting territories, all documented eagle use on the project site occurred during the period in which eagles were not actively nesting, incubating, or rearing chicks.

2.3 Stage 3 – Predicting Eagle Fatalities

Factors potentially associated with wind turbine collision risk for eagles are presented in the draft ECP guidance (USFWS, 2011). Some of these may be present during operation of the project and may include bird density, age, residency status, season, flight style, interaction with other birds, and hunting or presence of foraging opportunities. Information that conclusively defines the functional relationship of these factors to actual eagle mortality during operation is, for the most part, unavailable; however, these risk factors make intuitive sense and are therefore considered in AWD's assessment of risk. AWD's assessment and conclusions related to risk are based on the data collected from March 2009 to March 2011. Risk analysis and conclusions are summarized in Table 3 and described in more detail in the following sections.

TABLE 3
Assessment of Golden Eagle Risk Factors
Alta East Wind Project

Risk Factor	Analysis	Conclusion
Bird Density	Eagle use is very low when compared to other facilities with similar preconstruction data.	Low risk
Age	Age of individuals was estimated during point count surveys; however, inconsistent age determination and low detection rates preclude understanding of the age structure of eagles occasionally using the project area. Although age alone is an unreliable stand-alone indicator of risk for a variety of reasons, each age class may have its own particularly vulnerabilities that are dependent on a variety of other risk factors and circumstances. The data available from the two years of study do not indicate that nesting does not occur onsite and the presence of fledglings or juveniles that might potentially be more vulnerable to collision than other age classes are not common onsite.	Low Risk
Residency Status	Distance of nests from the project suggest nesting eagles occur in reasonable proximity to the site to present risk. Nesting territory occupants, and adult and juvenile floaters, may comprise the population of eagles using the site; however, this cannot be determined from the data available. No evidence of foraging or territorial behavior was observed on the project and the apparent spatial arrangement of nest territories indicated by the nesting survey results suggests that territorial behavior may be unlikely in or near the project.	Low Risk

TABLE 3
Assessment of Golden Eagle Risk Factors
Alta East Wind Project

Risk Factor	Analysis	Conclusion
Season	Potential relationship of eagle use with fall and winter season, as evidenced during fall 2010 and winter 2010/2011 avian use data. Foraging, perching, or consistent use of specific areas was not documented; however, seasonal and annual variability was evident.	Potential Seasonal Variation in Risk
Flight Style	Soaring and gliding is documented in and out of the altitudes associated with WTG collision risk; however, frequency of use is low and no higher-risk flight behaviors, such as hunting, kiting, soaring, or stooping were observed.	Low Risk
Interaction With Other Birds	With the exception of two juvenile eagles observed on Feb, 17, 2011, all observations were of individual birds. No evidence of territoriality o interaction with other eagles was observed	Low Risk
Hunting	Not observed.	Low Risk
Presence of Foraging Opportunities	Not observed, but likely present at times or in localized areas. Quantitative preybase studies were not completed; however indirect evidence (low raptor use, low overall avian use, few incidental observations of big game, livestock and small mammals, and no observations of unique concentrations of prey) supports the inference that prey concentrations and foraging opportunities are uncommon and/or localized.	Low Risk
Topographic Features for Slope Soaring	The majority of the project is flat and rugged topography is limited to the north and western edges. Slope soaring was not observed	Risk may vary with topography
Topographic Features for flight corridors	The majority of the project is flat and rugged topography is limited to the north and western edges. A possible connection with avian use point 3 may be evident; however, observed use was low and not specific to a particular corridor	Low Risk
Perch Structures	No perching eagles were detected. Additionally, no unique perch sites associated with topography or artificial structures are present on the project.	Low Risk

2.3.1 Collision Risk

Eagle density, age, residency status, time spent in zone of risk, season, flight style, interaction with other birds, and hunting or presence of foraging opportunities all may influence the likelihood of an eagle colliding with a WTG or other project feature. No eagles were observed within the project boundary during surveys completed from May 11, 2009 through September 2010, indicating that use of the project by eagles during this period was very limited. Because eagles were not detected using the project area during this time period, it is appropriate to conclude that eagle use of the project area was very low during this study period.

During the May 11, 2009 to May 6, 2010 evaluation period, eagle use within the project area was distinctly different from the area observed to the north and west, where eagle use was documented. This difference in eagle use between years could be associated with proximity to nesting territories during the nesting season or other factors, but may also indicate poor habitat quality on the project area, as described in Section 2.2.3, Assessment of Nonbreeding Habitat. Regardless of the cause, the difference in eagle use between years, and between the higher use area detected to the north and northwest of the project is measurable in the data collected, suggesting that the project area may provide less favorable habitat or less likely to be selected by eagles in the vicinity of the project than areas located to the north and northwest. Moreover, important foraging habitat and foraging use were not observed during two years of study, nor were the majority of the risk factors presented and discussed in Table 3, which indicates that collision risk to eagles is extremely low, and the project is well-sited from a landscape perspective with regard to minimizing risk of collision for eagles. Eagle territories could expand to include the project area during years in which prey resource distribution differs from that of the study period; however, during this study period, the project area was not preferred by eagles in the project vicinity.

No eagles were recorded on the project during two summers (2009 and 2010) and during winter 2009–2010. However, eagles were recorded during fall 2010 and winter 2010–2011. Low detection rates of eagles on the project area indicate that the area could be considered of low importance to the local population; however, regional assessment of golden eagle distribution would be necessary to determine this at the regional level. Minor-scale indirect impacts could be expected through potential displacement of a small number of eagles during project construction and operation; however, the likelihood of an eagle colliding with a WTG during operation is highly unlikely.

Field data analyzed to date indicate that topographic features within the project area are not conducive to slope soaring or creation of potential flight corridors. If such features were present, high mean use values by soaring species and/or birds exhibiting regular or seasonal movements through a particular area would have been detected in the two years of study. No foraging sites, roost sites, or perch structures have been identified after 22 months of study. Therefore, although minor eagle use is documented within the project area during baseline studies, the actual risk of collision with proposed WTGs is very low for eagles in the area. The low levels of documented use suggest that eagle density is very low and migration corridors or stopover habitat are not present onsite. Based on studies completed to date, it is appropriate to conclude that potential collision risk to eagles is very low.

2.3.2 Impacts to Nests or Nesting Territories

The nearest known eagle nest is located 3.0 miles northwest of the nearest proposed wind turbine. No eagle nests were documented within the project area, and use of the project is so low that although a nesting territory or territories may overlap the project area, it is unlikely that important habitats, which might be contained within nesting territories is included in the project area. Spring 2010 surveys indicate that the average inter-nest distance between the three occupied nesting territories adjacent to the project is approximately 5 miles. One-half the inter-nest distance has been used as an approximation for the territory boundary in a number of raptor studies (Thorstrom, 2001; Wichmann et al., 2003; Soutullo et al., 2006). Therefore, this distance can be used to delineate which nesting territories and

associated breeding and juvenile eagles are likely to be affected by the project, either through injury, mortality, or disturbance. Because no nests occupied in 2010 or 2011 are within 2.5 miles of the project no impacts on nesting territories are anticipated to result from project construction or operation using internest distance as an index to territory size. Although nests are within the 10 mile radius of the project, use by eagles of the area proposed for turbine installation is very low. This no impact determination to nesting territories is further supported by Hunt (2002), in which only 2 of 47 radiotagged breeders were killed by turbines in a radiotagged sample of 117 birds in the Altamont Wind Resource Area, suggesting that birds on nesting territories (breeders) are less vulnerable to collision.

Historical nest and territory data or population status or assessment data are not available from the USFWS to evaluate historical eagle territory locations in and near the project area and or the current status of golden eagles in the region (personal communication, Ashleigh Blackford, December 10, 2011); however, AWD has assessed the potential impacts on golden eagles in the absence of these data. Their conclusion is that impacts to nesting golden eagles are unlikely, and thus the productivity of the regional population will be unaffected by construction and operation of the project.

It is generally understood that nonbreeding eagles use areas on the margins of territories occupied by breeding adults (Watson, 1997; Hunt, 1998; Caro et al., 2010). These "floaters" have been shown to be more vulnerable to collision with turbine blades at wind energy projects than locally breeding adults and juveniles are (Hunt et al., 1999 and 2002); however, Hunt (2002) associates this risk with hunting of live prey behavior, which was not observed and is not common based on the data collected for the project. WTGs sited proximal to eagle nesting territories may pose risks to eagle populations because population stability is likely influenced by a robust nonbreeding cohort in the form of floaters, to replace breeding individuals that die. The systematic, observational point-count approach used to document frequency of eagle use of the project footprint, coupled with the results of the nesting territory analysis, suggest that some of the eagles on the project may be floaters. However, the frequency at which these potential floaters use the site, and the apparent lack of importance of the project area to eagles for foraging, roosting, or perching, suggest that potential impacts on floaters or non-nesting birds would not occur. .Based on studies completed to date, it is appropriate to conclude that risk of project impacts to nesting eagles, or floaters of any age, would be low and does not warrant mitigation actions.

2.3.3 Foraging Habitat Loss

During the first 12 months of evaluation, eagle use within the project area was distinctly different from that in the area observed to the north and northwest, where eagle use is documented. Subsequent data collected in fall 2010 and winter 2010 and 2011 indicate that eagles may use the project area at low levels during the nonbreeding season. It is also possible that established territories could expand to include the project area during years in which prey resource distribution differs from that during the study period. However, eagle foraging or perching was not detected on the project area, and use indices indicate low importance of this specific site for foraging eagles. Therefore, impacts on foraging habitat are expected to be minimal.

2.3.4 Wintering Habitat Use

Potential for seasonal variability in use of the project area exists, and data indicate that the project is likely more attractive to eagles in the fall and winter than during other times of the year. However, winter use of the project by eagles is very low; consequently, the importance of this wintering habitat is likely very low. Based on studies completed to date, it is appropriate to conclude that potential project impacts on important wintering habitat for eagles are expected to be minimal.

2.3.5 Fatality Estimates

The interaction of topographic features, seasons, and wind currents does not appear to create favorable conditions for slope soaring or kiting (stationary or near-stationary hovering) in the vicinity of the proposed turbines. Foraging or territorial behavior that might distract eagles using the project and presumably make them less vigilant has not been documented onsite. The number of recorded golden eagles has been uniformly low across all seasons.

Compared to other projects in California and Arizona, Alta East presents some of the lowest overall raptor use (Chatfield et al., 2010a and 2010b, 2011). Western Ecosystems Technology, Inc. compared annual mean raptor use at the project from May 2009 to May 2010 (Year 1 Study), which represents the period of highest eagle and during which no eagles were documented on the project site, with 39 other wind energy facilities that implemented similar protocols and had data for three or four seasons. The annual mean raptor use at these wind energy facilities ranged from 0.09 to 2.34 raptors/plot/20-minute survey. Based on the results from these wind energy facilities, a ranking of seasonal raptor mean use was developed and under this ranking, mean raptor use at the Alta East project (0.09 raptor/plot/20-minute survey) is considered to be very low, ranking second lowest compared to the 39 other wind energy facilities. Additionally, during the Year 2 study, for which eagles were documented onsite, mean use values for all raptors was similarly ranked third lowest of 44 comparable study areas. Very few recorded observations of eagles at the Alta East project preclude similar comparisons for eagles only; however, such low detection rates indicate very low risk of impacts to eagles.

During the May 2009–May 2010 avian use study, 26 percent (11 of 43) of raptor observations consisted of golden eagles; however, none of these occurred in the area where eagles would be considered at risk from the project. During summer 2010, in which avian survey points more accurately assessed the area proposed for WTG installation, no eagles were observed on the project. From July 10 through June 1, approximately 22 percent (8 of 36) of raptor observations consisted of eagles.

The discussion below evaluates fatality estimates using three different approaches: regression analysis, eagle use/mortality rate comparison, and collision risk modeling.

2.3.5.1 Regression Analysis

One method of estimating site-specific mortality predictions for eagles is to look at mean use for all raptors, and then look at the proportion of the overall raptor use attributed to golden eagles. Using methods described in Chatfield et al. (2010, 2011), a regression analysis of raptor use and mortality for 20 new-generation wind energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant

correlation between use and mortality (R^2 = 65%). Using this regression to predict overall raptor collision mortality at the project (based on an adjusted mean raptor use of 0.09 raptors/800-m/20-min survey) estimated for the project, yields an estimated fatality rate of less than 0.01 fatalities/MW/year or less than one raptor fatality per year for each 100-MW of wind-energy development (WEST 2012; Appendix B). A 90 percent prediction interval around this estimate is zero to 0.19 raptor fatalities per MW per year.

Golden eagle use accounted for approximately 22.2 percent of the observed raptor use at the AEWRA during the two years of study; therefore, assuming the proportion of eagles observed is related to the proportion of eagle mortality that would be expected, an eagle mortality rate of 0.0022 eagles/MW/year (0.0066 eagles/turbine/year), or 0.700 eagle fatalities per year, would be estimated for the proposed 318-MW wind energy project (Table 2). Using this prediction, project-wide eagle mortality would be approximately three to four eagles every five years. This approach is likely conservative because golden eagles are easier to detect than other raptor species; therefore, the proportion of raptor use attributed to golden eagles is likely overestimated due to higher detectability. It is also probable that collision risk for eagles is different than for other raptors.

This regression analysis currently one means of predicting raptor fatality, and AWD cannot identify any specific behaviors or risk factors that would cause the eagles present on the project to be at risk of collision fatality (see Table 3); therefore, eagle fatality would be predicted to be zero for the project using this method and AWD concludes that take of eagles is highly unlikely during operation.

2.3.5.2 Eagle Use/Mortality Rate Comparison

By comparing mean use values of eagles with projects where eagle take has been documented, and not documented, after robust fatality studies at 13 projects in western and Midwestern states, no take has been documented where annual eagle use values are less than 0.05/20-minute survey period (WEST 2012; Appendix B) Overall mean golden eagle use recorded at the Alta East project during the two years of study (0.02 eagles/800-m plot/20-min survey) is within the range of preconstruction eagle use values estimated for projects with no documented take of eagles during operation. This analysis strongly suggests that low, if any, golden eagle mortality would be expected in any given year at the AEWRA.

2.3.5.3 Collision Risk Modeling

A third approach to attempt to predict the frequency of eagle fatalities associated with a wind project is to use the modeling approach prescribed in the USFWS Draft Eagle Conservation Plan Guidance (USFWS 2011). Although substantial assumptions are used in this model that suggest a functional relationship between eagle use and behavior and risk of collision, using an assumed turbine specification of the Vestas V90-3.0 MW turbine and best and worst case scenarios of 99 and 95 percent avoidance rates, yields take estimates for Alta East of 0.114 golden eagle fatality per year (99% avoidance assumed) and 0.57 eagles/yr (95% avoidance assumed). These equate to less than one eagle fatality every 5 yrs to approximately 3 every five years for the proposed 300-MW project.

Each analysis presented above involves substantial assumptions; however, the three approaches generate project-wide fatality estimates for golden eagles ranging from zero to

0.7 eagle fatalities/yr. Although some golden eagle fatalities may occur, based on the use data and prediction models currently available to assess risk, it appears that the number of fatalities would likely be small. Overall eagle use of the project area is low, risk factors are determined to be rare or nonexistent on the site, and fatality of eagles would be expected to be highly unlikely, even without the incorporation of advanced conservation practices.

2.3.6 Cumulative Impacts

Typical activities that may be disruptive or detrimental to eagles occurring throughout the project region, although very limited on the project area, include illegal shooting, off-highway vehicle activity, loss of habitat to development through non-wind industry-related development, and general encroachment into nesting territories. AWD has not obtained information regarding the specific extent of these detrimental activities; however, each likely contributes to negative impacts on the regional eagle population.

Additional wind power projects are operating in the Tehachapi region. AWD is aware that eagle fatalities have been documented at the Pine Tree wind project approximately 7 miles north of the Alta East project, the Alite Project located approximately 10 miles east, and the Alta Oak Creek Mojave (AOCM) project located approximately 2 miles west. Although specifics about the date and age of the individual(s) killed are not available at each project, with the exception of AOCM where a juvenile eagle was killed during the winter season, it is possible that these impacts could influence the eagle territories documented within 10 miles of the project and thus influence the dynamics of the local eagle population.

The AOCM project consists of up to 720 MW of planned wind energy generation capacity—150 WTGs (300 MW) were installed during 2010. AOCM was granted state and county permits with USFWS input. This project is sited to minimize impacts on eagles and incorporates appropriate measures to detect or mitigate impacts on eagles should they occur. Baseline eagle use at this project site was very low relative to other projects in the geographic range of golden eagles, and comparable to that documented at Alta East.

For the purposes of this ECP, cumulative impacts on golden eagles could occur if the incremental impacts associated with the project are added to the impacts of past, present, and reasonably foreseeable future actions (identified above) in the vicinity of the project. Cumulative impacts could potentially result in an adverse effect on golden eagles in the region; however, no significant adverse project impacts are anticipated to affect eagles or their requisite habitats for nesting, foraging, or nonbreeding seasonal use as a result of construction or operation of the project. Furthermore, construction and operation best management practices (BMP) are presented in this plan to further minimize risk of project-related impacts and to mitigate impacts, if necessary. Therefore, the addition of the project as proposed, with measures implemented as presented in this plan, would result in no cumulative impacts on eagles.

2.4 Stage 4 – Advanced Conservation Practices

The analyses and documentation provided in this ECP show the project's risk to eagles is very low. However, this minimal risk can be further reduced through siting, construction, and operation measures, including mortality monitoring during operation and a plan of

action if eagles are taken during construction or operation. These advanced conservation practices (ACPs) are presented in the following sections.

2.4.1 Project Siting

Golden eagle use and nesting documented during baselines studies for the project were limited to the rugged topographical area north and west of the project area in 2009. The project site was modified in June 2010 to include additional area extending southward from the golden eagle use areas and extending development into the flat, nonrugged topography. The project includes repowering a historical wind power project site north of SR 58 on BLM lands and infilling existing wind facilities south of SR 58 in the area of Cameron Ridge. Overall, the project area presents a very low risk of direct impacts and the potential for very minor indirect impacts on golden eagles. The project is appropriately sited on the landscape as it relates to the impact on eagles.

2.4.2 Micrositing of Project Features

Baseline surveys for the project resulted in no documented use by golden eagles from May 11, 2009 to June 2010. The entire project was evaluated from July 1 2010 to October 7, 2011 and no eagle use was documented. Eagles were recorded in the project area during fall 2010 and winter 2010/2011. Therefore, although some eagle use of the project area may occur during construction or operation, no unique habitat features such as prominent perch sites (rock outcrops, cliffs, trees) or unique concentrations of prey are evident. Additionally, the area north and west of the project is documented as a location for which no direct or displacement impacts on eagles would be expected to occur. Cameron Ridge, in the western portion of the project and south of SR 58, has operating WTGs along the ridge. The ridge may have provided historic perch locations for eagles prior to development, but now, this ridge presents existing wind development Therefore, the proposed addition of three wind turbines along Cameron Ridge for this project is presented as optimal siting of turbines because the infill approach to development in this area is not likely to further affect potential eagle habitat, which is already degraded or nonfunctional as a result of previous development.

All other project features are located away from the higher elevation and rugged topography that is associated with the eagle use documented to the north and west of the project. Therefore, micrositing in response to eagle use or eagle habitat is not necessary for the remainder of the project features.

2.4.3 Construction Measures

Appropriate site-specific mitigation measures for golden eagles have been identified by AWD and include, but may not be limited to, measures specified in the following BMPs. These measures are consistent with those identified in BLM ROW grants received by the Applicant on nearby wind development projects, and applicable measures from the adjacent AOCM project. All potentially applicable measures from the above references are listed below. The BLM Wind Energy Programmatic Environmental Impact Statement also includes BMPs and mitigation measures for a plan of development and project design. Upon completion of the resources surveys and studies, applicable mitigation measures will be refined, and additional mitigation measures may be incorporated with input from BLM and USFWS.

Because courtship and nesting areas are not located in the project vicinity, construction activities would not need to be scheduled to avoid important periods of eagle nesting. If new nests or eagle use is detected during project construction, timing and avoidance measures would be implemented as appropriate in coordination with USFWS.

2.4.4 Minimizing Potential Habitat Disturbance

To mitigate habitat reduction or alteration during construction, the following measures shall be implemented:

- The size of all disturbed areas would be minimized.
- Where applicable, the extent of habitat disturbance would be reduced by keeping vehicles on access roads and minimizing foot and vehicle traffic through undisturbed areas.
- Habitat restoration activities would be initiated as soon as possible after construction activities are completed.
- Existing roads and utility corridors would be used to the maximum extent feasible.

2.4.5 Minimizing Potential Direct Disturbance

- Permanent meteorological towers, transmission towers, and other facility structures would be designed to discourage birds from perching or nesting on them (e.g., non-lattice towers, APLIC [2006] standards). Meteorological towers placed on BLM lands would adhere to BLM Guidelines.
- All guy wires installed on project structures, such as temporary meteorological towers, will be marked with bird flight diverters.
- All permanent meteorological towers will be free standing without the use of guy wires.
- Power lines would be configured to minimize the potential for electrocution of birds, by following established guidelines (e.g., Avian Power Line Interaction Committee [APLIC], 2006 and USFWS, 2005).
- Explosives would be used only within specified times and at specified distances from sensitive wildlife or surface waters as established by the BLM.
- If an injured or dead golden eagle is encountered during construction, AWD will stop work within the immediate vicinity. AWD will notify the USFWS before construction within the immediate vicinity is allowed to proceed.
- Prior to initial construction activities (e.g., mechanized clearing or rough grading), a qualified biologist will conduct a pre-construction sweep of the project site for golden eagle use. During these surveys the biologist will perform the following tasks:
  - Inspect the project area for eagles, nests, or signs of nesting or courtship behavior.
  - If an eagle, nest, or sign of nesting is discovered, measures will be taken to ensure that no impacts to these nests or individuals occur during construction.
- AWD will provide environmental training to all personnel working on the site during project construction. The training will include a review of golden eagle identification

and ecology to promote awareness and facilitate implementation of appropriate measures if an eagle is encountered or killed. If an eagle is encountered or killed, the appropriate employee will be required to contact the on-call biological services provider for the project.

2.4.6 Operation Measures

As part of AWD's mortality monitoring and reporting program, AWD will provide environmental training to all personnel working onsite during project operation. The training will include a review of golden eagle identification and ecology to promote awareness, and facilitate implementation of appropriate measures if an eagle is encountered or killed. The importance of onsite staff is significant in that they are onsite daily, can become familiar with how all wildlife move through and use the project site and vicinity, are the eyes and ears of environmental staff for identifying project risk or impact issues, and can help identify ways to reduce unexpected impacts if they are detected. Additionally, onsite management efforts, such as removing carcasses or limiting debris piles or food sources for potential prey, will reduce attractants to eagles, such as increased localized prey densities or other foraging opportunities (livestock carcasses).

Informal operational monitoring will be performed during the life of the project as a course of business by all AWD operations staff. Staff will be required to report all eagle observations, nesting behavior, and nests, and record fatalities and injuries. While this monitoring will not be statistically based, it will allow detection of issues that may potentially occur onsite.

Formal operational monitoring and reporting measures will also be implemented and are described in detail in Section 2.5, Stage 5 – Post-construction Monitoring. If an eagle is encountered or killed during project operations, the employee involved will be required to implement the appropriate response protocol, which will include notification of USFWS.

2.5 Stage 5 – Post-construction Monitoring

Post-construction monitoring will enable AWD to document eagle fatalities if they occur and identify factors associated with eagle fatalities that might warrant additional ACPs to specifically address the identified risk factor. Likewise, the monitoring program would enable potential improvement or elimination of ACPs found to be ineffective. Implementation of the proposed monitoring program will help USFWS, BLM, and AWD to evaluate the effectiveness of the ACPs. As part of AWD's mortality monitoring and reporting program, AWD will complete post-construction monitoring and reporting to determine whether baseline predictions of no impacts on eagles are consistent with operational outcomes. The monitoring program is explained below.

2.5.1 Fatality Studies

AWD or its representatives will perform post-construction eagle mortality monitoring in the first, third, and fifth years following the initial operation of the project, to demonstrate that the level of incidental injury and mortality does not result in an unanticipated long-term decline in populations of eagles in the region. Monitoring would be ceased, expanded, or

continued in response to the data collected. Post-construction mortality monitoring will include a mortality analysis, which will be conducted as follows:

- AWD will provide BLM and USFWS with the results of the mortality study for eagles annually. A qualified biologist will conduct mortality monitoring using a statistically significant sample size of operational turbines within the project area, not to exceed 33 percent of the WTGs. Depending on the results of the monitoring, more or fewer turbines may be monitored each subsequent year of study.
- All golden eagle fatalities will be reported to USFWS and BLM within 24 hours of detection. Such reports would include GPS location, photographs, and related information describing the incident.
- The mortality analysis will note species number, location, distance from the turbine for each recovered eagle, and apparent cause of mortality.
- The mortality monitoring will follow standardized guidelines outlined by the CEC and will include carcass scavenging and searcher efficiency trials. If improved field or data analyses methods become generally accepted practice by the wind and wildlife scientific community, and are deemed acceptable by AWD's avian biologists, such methods will be implemented for the project.
- The results of the mortality analysis will be provided to USFWS. At a minimum, the mortality analysis will consider the following:

  i) Number of annual eagle mortalities per turbine
  ii) Comparison to existing data on wind farm mortality

- If after the post-construction eagle mortality monitoring completed during the fifth year of operation, data indicate that the project is resulting in unanticipated significant adverse impacts on the population of eagles or is significantly interfering with any eagle social or behavioral dynamic, the project proponent will consult with USFWS and BLM as described in Section 3.0, Adaptive Management.

2.5.2 Nesting/Breeding Monitoring

- AWD or its representative will conduct post-construction breeding monitoring of eagle territories within 10 miles of the project in the first and third years following the project's initial operation. Post-construction breeding monitoring will include aerial surveys completed in accordance with the USFWS 2010 Inventory and Monitoring Protocol recommendations (Pagel et al., 2010). Survey results will be provided annually to BLM and USFWS.
- If the project results in a level of incidental injury and mortality to eagles, AWD will undertake supplemental compensatory measures to support regional conservation of migratory birds in accordance with measures presented in Section 3.0, Adaptive Management.

SECTION 3.0

Adaptive Management

3.1 Accounting for Policy Changes

With the implementation of BLM IM 2010-156 and the publication of draft policies in the Federal Register on February 18, 2011, regarding golden eagle take permitting and ACPs, it is understood that commitments made in this ECP may require adaptation relative to the forthcoming guidance. AWD would work collaboratively with BLM and USFWS to apply necessary policy changes to the project ECP.

3.2 Agency Coordination

All study results pertaining to golden eagles will be provided to USFWS and BLM on an annual basis.

SECTION 4.0

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Appendix A
USFWS Letter of Concurrence

APPENDIX A

USFWS Letter of Concurrence

This attachment will be provided in a later submittal

Appendix B
Alta East Golden Eagle Fatality Predictions
Western Ecosystems Technology, Inc.
Technical Memorandum

NATURAL RESOURCES ◆ SCIENTIFIC SOLUTIONS

Western **E**co**S**ystems **T**echnology, Inc. ◆ 2003 Central Avenue ◆ Cheyenne, Wyoming 82001
Phone: 307.634.1756 ◆ Fax: 307.637.6981 ◆ Website: www.west-inc.com

TECHNICAL MEMORANDUM

Golden Eagle Fatality Predictions for the Proposed Alta East Wind Resource Area Kern County, California

Submitted by:
Western EcoSystems Technology, Inc.

February 3, 2012

INTRODUCTION

From May 11, 2009 through June 1, 2011, on behalf of CH2M HILL Engineers, Inc. and Alta Windpower, LLC, Western EcoSystems Technology, Inc. (WEST) conducted baseline avian studies at the Alta East Wind Resource Area (AEWRA) in Kern County, California. These surveys were designed to document avian use patterns, identify potential risk issues, and assist with siting turbines to minimize impacts to avian resources. Because use of the AEWRA and adjacent areas by golden eagles (*Aquila chrysaetos*) was documented, and golden eagle nests were located in the surrounding landscape, the proposed project's potential impacts to eagles are important to understand in regard to developing a defensible risk characterization, which may (or may not) lead to an Eagle Conservation Plan and application for a programmatic take permit. The purpose of this document is to utilize the two years of site-specific baseline avian use data to provide golden eagle fatality predictions for the AEWRA. The results of these analyses indicate that a wind energy facility at the AEWRA would potentially take eagles at a rate of less than one per year. This memorandum summarizes the fatality prediction approaches and results.

STUDY AREA

The proposed AEWRA is located in southeastern Kern County, approximately two miles (3.2 kilometers [km]) north-northwest of the unincorporated city of Mojave, and 10 miles (16 km) east

of the city of Tehachapi. The study area comprises undeveloped rangeland on a combination of privately-owned land and land administered by the Bureau of Land Management.

The AEWRA falls within the high desert plains and hills on the western edge of the Mojave Desert. The Tehachapi Mountains are located to the north and west of the study area and transition into Mojave Desert towards the south and east. Elevations within the study area range from approximately 3,100 to 4,200 feet (ft; 940 to 1,280 meters [m]) above sea level, with the highest elevations occurring in the northern portion of the study area (Figure 1). The habitat ranges from lowland creosote (*Larrea tridentata*) scrub and Joshua tree (*Yucca brevifolia*) woodland in the southeast to juniper (*Juniperus* spp.) shrubland on the steeper, rocky slopes in the north. Water within the AEWRA is limited to a network of ephemeral drainages; there are no perennial surface water sources within the study area. Highway 58 bisects the AEWRA, an underground portion of the Los Angeles Aqueduct runs along the southeast corner of the study area, and a network of dirt roads and off-highway vehicle (OHV) trails run throughout the study area (Figure 1).

The project will consist of up to 106 3-megawatt (MW) model wind turbine generators (WTGs) and ancillary facilities for a total nameplate capacity of 318 MW. The WTGs planned for the project (Vestas V90-3.0 MW) have a wind-swept rotor diameter of 295 feet (90 m). The highest point of the rotor blade rotation is 410 feet (125 m) and the ground clearance for the rotor blades at their lowest point of rotation is 115 feet (35 m).

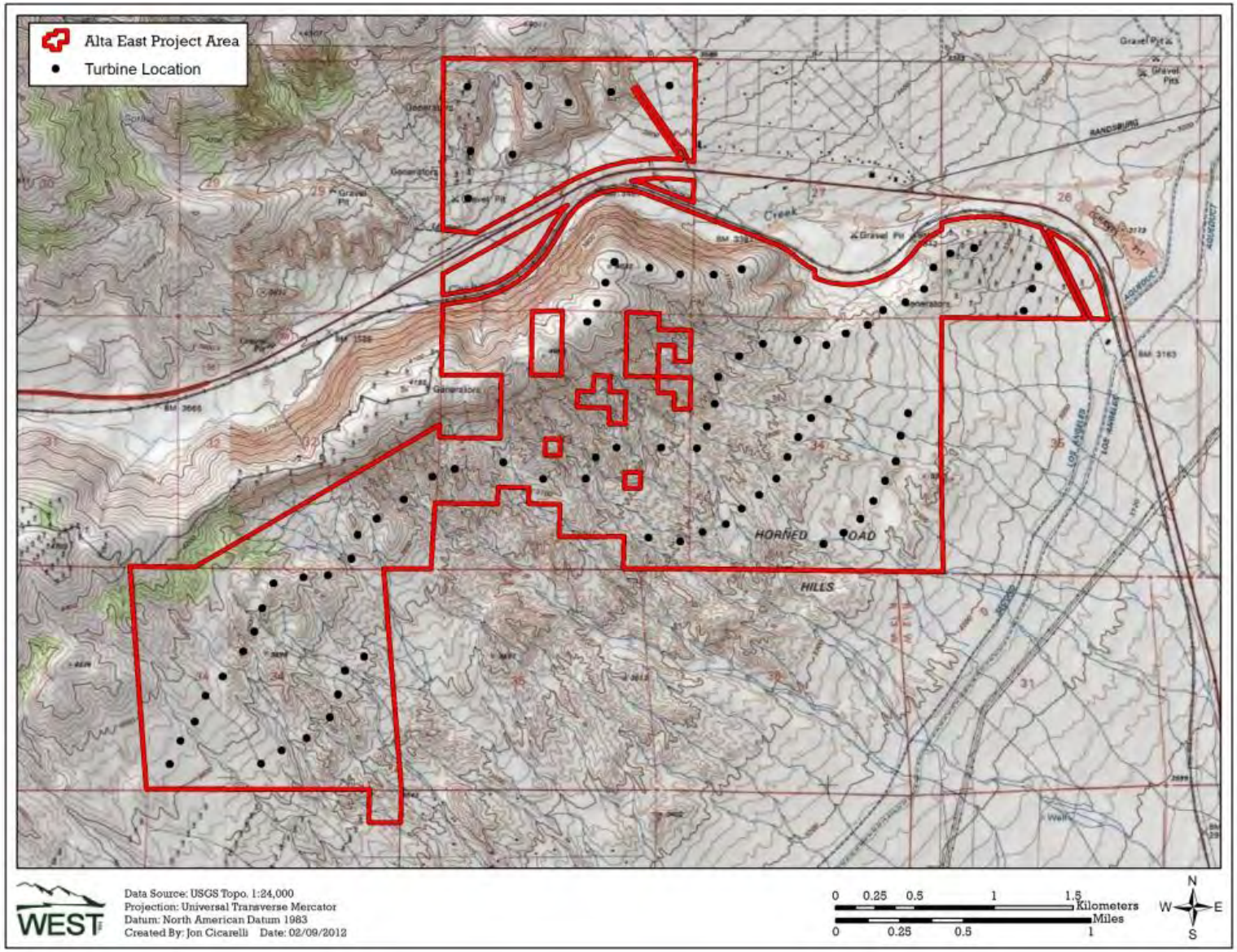


Figure 1. Map of the Alta East Wind Resource Area showing proposed turbine layout.

SITE-SPECFIC AVIAN USE SURVEYS

This golden eagle risk assessment is based on golden eagle observational data collected over two years of fixed-point avian use surveys conducted at the AEWRA in 2009/2010 and 2010/2011. The objective of the surveys was to estimate the seasonal and spatial use of the study area by birds, particularly diurnal raptors, defined here as kites, accipiters, buteos, harriers, eagles, falcons, and ospreys. The methods for those surveys are briefly described below. See Chatfield et al. (2010, 2011) for a more detailed explanation of how avian use data were collected and analyzed.

Survey Plots

Fixed-point avian use surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). During both years of the study, six points were selected to survey representative habitats and topography of the study area while providing relatively even coverage (Figure 2). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point. To the extent possible, survey stations were selected to be consistent between the two years of study; however, due to changes to land access and changes to the project boundary, points 4, 5, and 6 were relocated for the second year of surveys to more accurately assess the area currently planned for wind turbine installation (Figure 2). For the purposes of this risk assessment, golden eagle use data collected at survey points 5 and 6 during the first year of study (2009/10; see Chatfield et al. 2010) were not used in the fatality predictions because the survey plots and viewsheds lie entirely outside of the current project boundary.

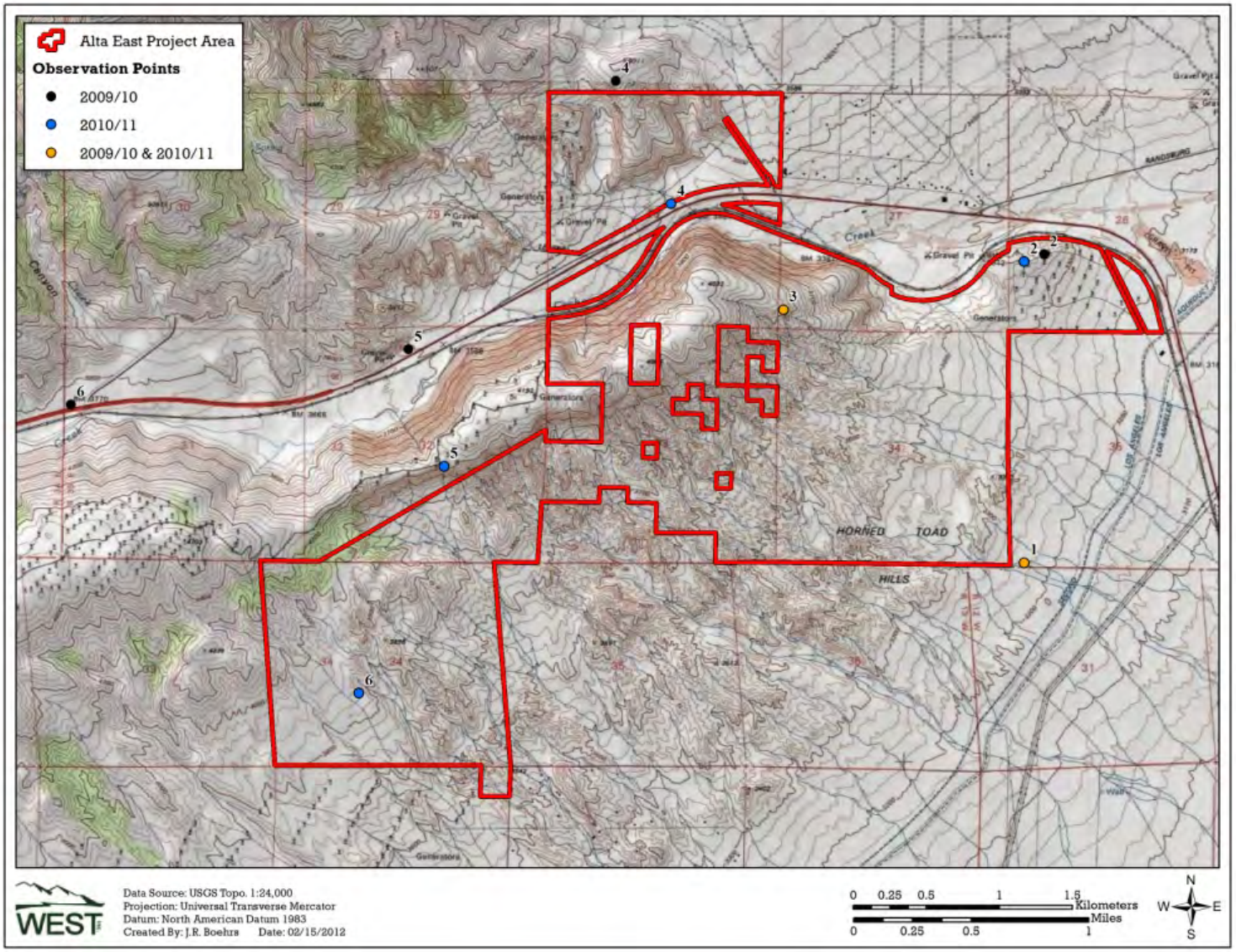


Figure 2. Locations of fixed-point bird use survey stations during the 2009/10 and 2010/11 survey periods at the Alta East Wind Resource Area.

Survey Methods

All species of birds observed during each 30-min fixed-point survey were recorded. Observations of large birds beyond the 800-m radius were recorded, but were not included in the statistical analyses. For small birds, observations beyond a 100-m (328-ft) radius were excluded from the analysis. The date, start, and end time of the survey period, and weather information, such as temperature, wind speed, wind direction, and cloud cover, were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. Behavior and habitat type were recorded based on the point of first observation. Approximate flight height and flight direction at first observation were recorded to the nearest 5-m (16-ft) interval. Other information recorded included whether or not the observation was auditory only and the 10-min interval of the 30-min survey in which the observation was initially noted.

Observation Schedule

Sampling intensity was designed to document seasonal bird use within the AEWRA. Fixed-point surveys were conducted from May 11, 2009 through May 6, 2010 and from July 10, 2010 through June 1, 2011. Surveys were conducted approximately once per week during each season: spring (March 1 to May 31), summer (June 1 to August 31), fall (September 1 to November 15), and winter (November 16 to February 28). Surveys were carried out during daylight hours, and survey periods varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed about the same number of times.

Survey Results

The two years of avian use surveys completed at the AEWRA in 2009/2010 and 2010/2011 (Chatfield et al. 2010, 2011) resulted in a combined diurnal raptor use estimate of 0.09 birds per 800-m plot per 20-minute survey period (Table 1). For golden eagles, the estimated use was 0.02 birds/plot/20-min survey (Table 1). Seasonal mean use for golden eagles ranged from zero eagles/plot/20-min survey during the spring and summer of 2011 to 0.05 during the winters of 2010 and /2011. Although each point was surveyed for 30 minutes during each visit, diurnal raptor and golden eagle use estimates have been adjusted to 20 minutes to allow for comparison to data collected at other wind energy projects by using only the first 20 minutes of each 30 minute survey period. It should be noted that no eagle observations were excluded via this adjustment.

Mapped flight paths for all golden eagles observed during the surveys are presented in Figure 2. Golden eagles observed at survey points 5 and 6 from the 2009/10 survey period were excluded from the analysis as these survey plots and their viewsheds lie entirely outside of the current project boundary. While eagles observed from point 4 during the 2009/10 study, and from points 1 and 5 during the 2010/11 study were outside of the current project boundary, these observations were included in the risk assessment due to their proximity to the study area and to allow for a more conservative estimate of take.

Table 1. Seasonal and overall mean use (observations per 800-m plot per 20-min survey) by year based on fixed-point observations of diurnal raptors and golden eagles at the Alta East Wind Resource Area.

Season	Year	Diurnal Raptors	Eagles
Spring	2010	0.05	0.01
	2011	0.13	0
	Mean	*0.09*	*0.01*
Summer	2010	0.03	0.01
	2011	0.03	0
	Mean	*0.03*	*0.01*
Fall	2010	0.03	0
	2011	0.12	0.01
	Mean	*0.08*	*0.01*
Winter	2010	0.17	0.05
	2011	0.18	0.05
	Mean	*0.17*	*0.05*
Overall	2010	0.07	0.02
	2011	0.12	0.02
	Mean	*0.09*	*0.02*

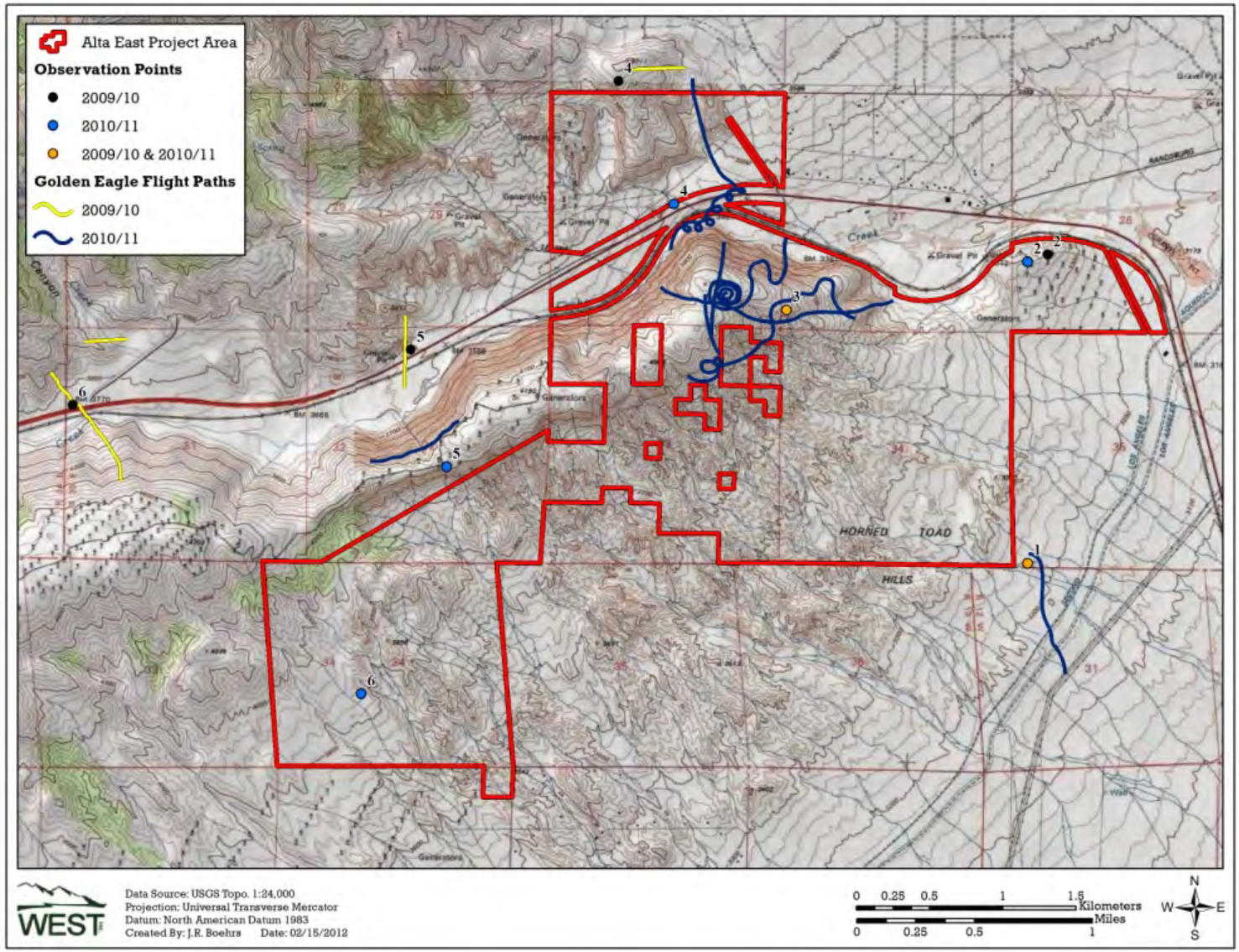


Figure 3. Approximate flight paths of golden eagles observed during the 2009/10 and 2010/11 bird use surveys at the Alta East Wind Resource Area.

FATALITY PREDICTIONS

In this report, we present three different approaches for predicting the expected level of annual golden eagle mortality at the AEWRA. The first approach examines the level of mortality observed at other wind projects in the western and Midwestern US in comparison to the level of golden eagle use at those projects, and correlates with these findings the golden eagle use observed at the AEWRA during two years of site-specific baseline avian use surveys (see Chatfield et al. 2010, 2011). The second approach to estimating potential golden eagle mortality involves estimating site-specific mortality predictions for all raptors, as described in Chatfield et al. (2010, 2011), and then looking at the proportion of those raptor observations that were golden eagles. The third approach applies the collision risk modeling technique prescribed in the USFWS Draft Eagle Conservation Plan Guidance (USFWS 2011).

Approach 1: Eagle Use / Mortality Rate Comparisons

This approach compares golden eagle use of the AEWRA with golden eagle use at currently operating wind energy facilities in the western and Midwestern US and the level of eagle mortality observed at those facilities. In Figure 4 below, golden eagle use at 13 western and Midwestern wind energy projects is presented in two columns: projects with no recorded golden eagle mortality and projects where eagle mortality has been documented. The data reported in Figure 4 are from wind energy facilities that implemented similar protocols to the avian use surveys conducted at the AEWRA, and have survey results for at least four seasons. Overall mean golden eagle use recorded at the AEWRA during the two years of study (0.02 eagles/800-m plot/20-min survey) is closer to the mean golden eagle use observed at facilities on the left side of Figure 4, where no recorded fatalities have been reported, than to the right side where golden eagle fatalities have been recorded. This suggests that low, if any, golden eagle mortality would be expected in any given year at the AEWRA. However, the actual level of use and the likelihood of mortality in a given year may be influenced by whether or not territories near the AEWRA are occupied and nests are successful. Based on seasonal use of the AEWRA by eagles during the two years of study, risk of mortality is expected to be highest in the winter (Table 1).

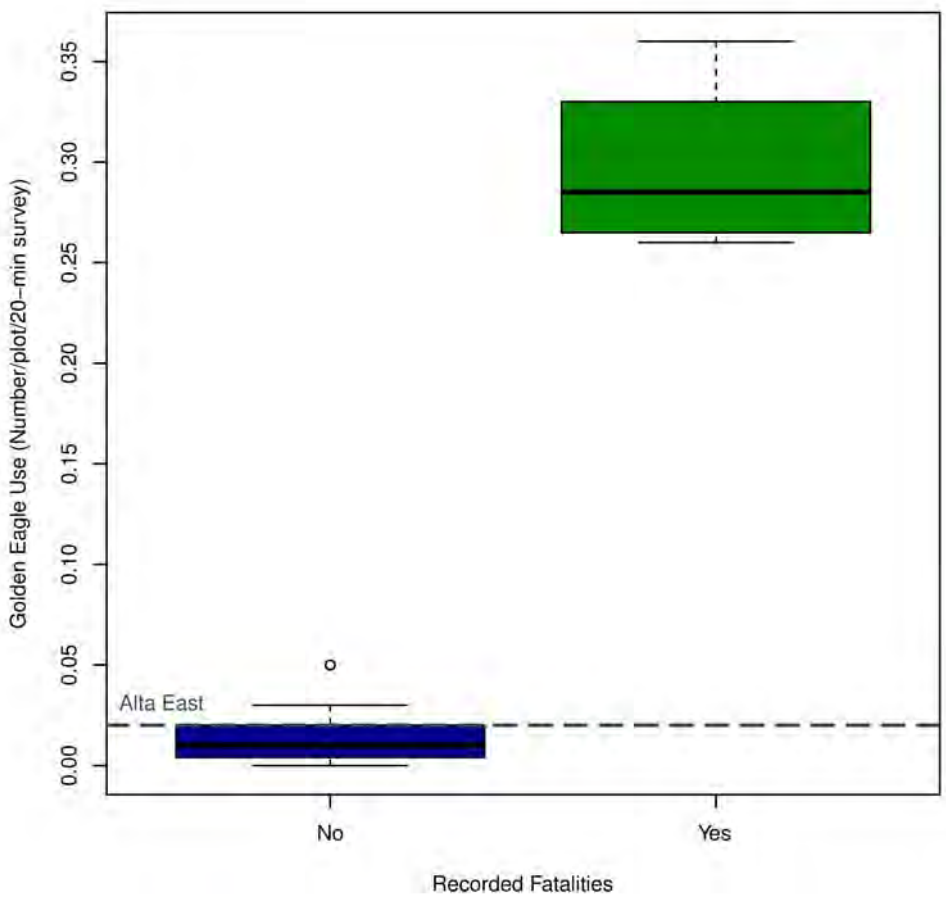


Figure 4. Average pre-construction golden eagle use values for wind energy facilities with and without observed golden eagle fatalities.

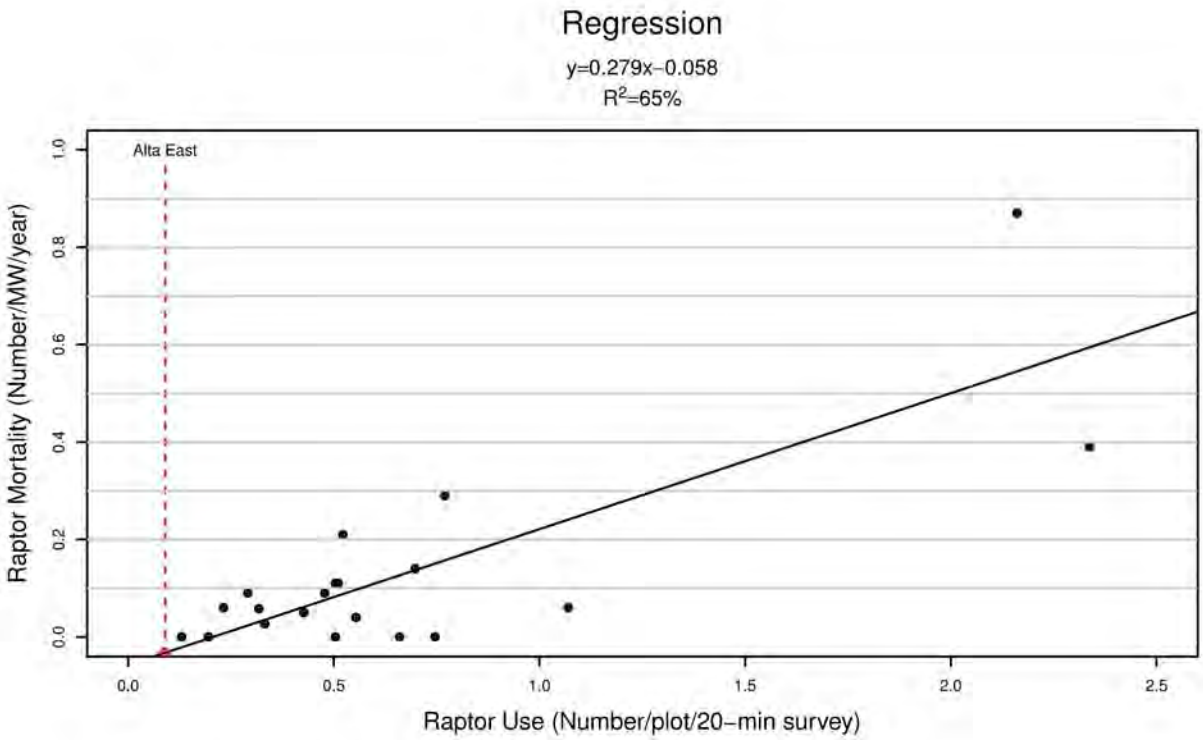
Data from the following sources:

Wind Energy Facility	Golden Eagle Use	Use Reference	Golden Eagle Fatality	Fatality Reference
Alta East, CA	0.02	Chatfield et al. 2010, 2011		
Campbell Hill, WY	0.36	Taylor et al. 2008	Yes	Taylor et al. 2011 In Press
Diablo Winds, CA	0.3	WEST 2006	Yes	WEST 2006, 2008
Elkhorn, OR	0.27	WEST 2005a	Yes	Enk et al. 2011 In Press
Foot Creek Rim, WY	0.26	Johnson et al. 2000b	Yes	Young et al. 2003b
Wild Horse, WA	0.05	Erickson et al. 2003c	No	Erickson et al. 2008
Combine Hills, WA	0.03	Young et al. 2003c	No	Young et al. 2006
Leaning Juniper, OR	0.02	Kronner et al. 2005	No	Kronner et al. 2007; Gritski et al. 2008
Hopkins Ridge, WA	0.01	Young et al. 2003	No	Young et al. 2007
Stateline, OR/WA	0.01	Erickson et al. 2002b	No	Erickson et al. 2004b
Vansycle, OR	0.01	Erickson et al. 2002b	No	Erickson et al. 2000
Klondike, OR	>0.01	Johnson et al. 2002	No	Johnson et al. 2003
Nine Canyon, WA	>0.01	Erickson et al. 2001	No	Erickson et al. 2003b
Grand Ridge, IL	0	Derby et al. 2009	No	Derby et al. 2010b

Approach 2: Eagle Mortality as a Proportion of Overall Raptor Mortality

Another approach to estimating potential annual eagle mortality at the AEWRA is to estimate site-specific mortality predictions for all raptors, and then look at the proportion of the overall raptor use attributed to golden eagles. Using methods described in Chatfield et al. (2010, 2011), a regression analysis of raptor use and mortality for 20 new-generation wind energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality (R^2 = 65%; Figure 5). Using this regression to predict overall raptor collision mortality at the AEWRA (based on an adjusted mean raptor use of 0.09 raptors/800-m/20-min survey; Table 1) yields an estimated fatality rate of less than 0.01 fatalities/MW/year or less than one raptor fatality per year for each 100-MW of wind-energy development. A 90% prediction interval around this estimate is zero to 0.19 raptor fatalities per MW per year.

Golden eagle use accounted for approximately 22.2% of the observed raptor use at the AEWRA during the two years of study; therefore, assuming the proportion of eagles observed is related to the proportion of eagle mortality that would be expected, an eagle mortality rate of 0.0022 eagles/MW/year (0.0066 eagles/turbine/year), or 0.700 eagle fatalities per year, would be estimated for the proposed 318-MW wind energy project (Table 2). Using this prediction, project-wide eagle mortality would be approximately three to four eagles every five years. This approach is likely conservative because golden eagles are easier to detect than other raptor species; therefore, the proportion of raptor use attributed to golden eagles is likely overestimated due to higher detectability. It is also probable that collision risk for eagles is different than for other raptors.



Overall Raptor Use: 0.09 raptors/800-m plot/20-min survey
Predicted Fatality Rate < 0.01 fatalities/MW/year
90.0% Prediction Interval (0, 0.19 fatalities/MW/year)

Figure 5. Regression analysis comparing raptor use estimations versus estimated raptor mortality.

Data from the following sources:

Wind Energy Facility	Raptor Use (birds/plot /20-min survey)	Reference	Raptor Fatality Rate (fatalities/MW/yr)	Reference
Diablo Winds, CA	2.16	WEST 2006	0.87	WEST 2006, 2008
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Tuolumne, WA	0.77	Johnson et al. 2006	0.29	Enz and Bay 2010
Leaning Juniper, OR	0.52	Kronner et al. 2005	0.21	Kronner et al. 2007
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007
Bighorn, WA	0.51	Johnson and Erickson 2004	0.11	Kronner et al. 2008
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Stateline, OR/WA	0.48	Erickson et al. 2003a	0.09	Erickson et al. 2004
Wild Horse, WA	0.29	Erickson et al. 2003c	0.09	Erickson et al. 2008
Elkhorn, OR	1.07	WEST 2005a	0.06	Jeffrey et al. 2009b
Wessington Springs, SD	0.23	Derby et al. 2008	0.06	Derby et al. 2010a
Biglow Canyon, WA	0.32	WEST 2005b	0.06	Jeffrey et al. 2009a
Zintel Canyon, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2003b
Foote Creek Rim, WY	0.55	Johnson et al. 2000b	0.04	Young et al. 2003b
Buffalo Ridge, MN	0.33	Johnson et al. 2000a	0.03	Johnsonet al. 2000a
Combine Hills, OR	0.75	Young et al. 2003c	0	Young et al. 2006
Dry Lake, AZ	0.13	Thompson et al. 2011	0	Thompsonet al. 2011
Grand Ridge, IL	0.20	Derby et al. 2009	0	Derby et al. 2010b
Klondike, OR	0.50	Johnson et al. 2002	0	Johnson et al. 2003
Vansycle, OR	0.66	WCIA and WEST 1997	0	Erickson et al. 2000

Table 2. Regression method to predict golden eagle fatality at the Alta East Wind Resource Area.

Variables	Site-Specific Raptor and Eagle Use Data
Raptor use (birds/plot/20-min survey)	0.09
Predicted raptor fatality per MW (Less than 0.01)	0.01
Eagle use (birds/plot/20-min survey)	0.02
Proportion of eagle use to raptor use	0.222
Predicted eagle fatality per MW	0.0022
Variables	**Project-wide Risk based on Specific Turbine Model**
	Vestas V90-3MW
MW/turbine	3
Number of turbines	106
Total MW	318
Eagle fatalities per year	0.700

Approach 3: Risk Collision Modeling

The final method for estimating eagle mortality applies the modeling approach prescribed in the USFWS Draft Eagle Conservation Plan Guidance (USFWS 2011). Tables 3, 4, and 5 contain parameters used to calculate a model of collision risk. An avoidance rate of 99% was used in the model following Whitfield (2009), as well as a more conservative avoidance rate of 95%.

Table 3. Values of parameters used to generate an eagle fatality estimate for the Alta East Wind Resource Area.

Exposure Rate Calculations	Vestas V90-3MW
Eagle Use (birds/plot/20-minute survey)	0.02
Use Survey Plot Radius (m)	800
Average flight time of eagles observed during surveys (min)	3
Survey Length (min)	20
Exposure Rate (flight minutes/minutes surveyed/survey area km^2)	0.00149
# minutes daylight hours	262,800
# turbines	106
Total risk area around turbines (Danger Zone) (km^2)	3.33
Exposure within the Danger Zone (min)	**1,305.78**

Table 4. Input values and calculations for the probability of collision/min flight in danger zone.

Exposure Time in RSA or RSV	Vestas V90-3MW
Turbine Height (m)	175
Rotor Radius (m)	45.0
Area of Rotor Swept Zone (m^2)	6,361.73
Area of Risk Zone (m^2)	35,000
Proportion of flight minutes below turbine height	0.88
Exposure minutes in Rotor Swept Zone	**207.6765**

Table 5. Variables for Probability of Collision (Tucker 1996).

Model Variables	Vestas V90-3MW
# Blades per turbine	3
Rotor Radius	45.0
Rotor RPM (Maximum Operating Speed)	18.4
Rotor Angular Speed	1.93
Wind Velocity (Maximum Operating Speed)	15
Axial Induction Factor	0.25
Average Adult Bird Wingspan (m)	2.1
Length of Birds (m)	0.9
Bird Aspect Ratio	2.33
Bird Air Velocity (m/s)	14
Tangential Threshold Speed (m/s)	25
P(Collision)	0.055

Using this modeling approach for Vestas V90-3.0MW turbines, we estimate a fatality rate of 0.114 eagles per year (less than one golden eagle fatality every five years) at a 99% avoidance rate, and 0.569 eagles per year (three fatalities every five years) based on the more conservative 95% avoidance rate (Table 6).

Table 6. Predicted annual eagle mortality based on 99% and 95% avoidance rates at the Alta East Wind Resource Area using the USFWS (2011) modeling approach.

Mortality Variables	Vestas V90-3MW
Eagle fatalities per year w/ 99% avoidance rate	0.114
Eagle fatalities per year w/ 95% avoidance rate	0.569

CONCLUSIONS

The three approaches generate project-wide fatality estimates for golden eagles ranging from zero to 0.7 eagle fatalities/yr. Although some golden eagle fatalities may occur, based on the use data and prediction models currently available to assess risk, it appears that the number of fatalities would likely be small. Based on the variation in seasonal use of the AEWRA by golden eagles observed during two years of study, risk of mortality is expected to be highest during the winter.

While use estimates (i.e., abundance) have shown promise at predicting raptor fatalities in general, use alone may not be a good predictor of eagle mortality. High raptor and eagle mortalities at wind energy facilities have been attributable to multiple factors including: high eagle densities, high prey densities, high turbine densities, and wind turbine/tower design (Erickson et al. 2002b, Hunt 2002). Topographic features that may concentrate eagle activity, such as ridge tops, upwind sides of slopes, and canyons where eagles can take advantage of wind currents that are favorable for soaring, hunting and travelling, as well as for migratory flights, may also increase the risk of collisions with wind turbines (Curry and Kerlinger 1998, NWCC 2010).

The site-specific information collected to date and the golden eagle fatality predictions suggest that the AEWRA is reasonably likely to take eagles, but it is unclear if that take would be at a rate greater than is consistent with maintaining a stable or increasing population. It is unclear to what degree any eagle mortality at the AEWRA would adversely impact the local population due to lack of information on the population in the region, and a lack of understanding of what level of mortality, if any, could be sustained. At Altamont Pass, where eagle mortalities have been documented to be relatively high, few breeding-age eagles are killed. Most of the fatalities are sub-adults and floaters (non-breeding adult birds; Hunt 2002); however, even with these annual fatalities recorded over a 15-year period at the site, the regional population was estimated to be stable (Hunt 2002). Recent raptor nest surveys continue to show all territories near Altamont Pass to be occupied by breeding golden eagles (100% occupancy, Hunt and Hunt 2006). If there is a delayed impact on the nesting or floating population at Altamont Pass, it has not been documented in the 20 years that the wind energy facility has been in operation. Furthermore, it might be considered unlikely that the fatalities from Altamont Pass would affect any one local population, but over time the loss of sub-adult and non-breeding adults could lead to broader population level effects, even if undetectable in localized populations. Because golden eagles are a long-lived species with relatively low reproductive output, adult survival is likely a key driver in population stability; hence, the loss of non-breeders and sub-adults may not be evident for many years.

The predicted fatality rates for eagles associated with the AEWRA are extremely low in comparison to Altamont Pass, and although Tehachapi area eagles may be affected differently than those in Altamont Pass, the weight of evidence suggests that the small number of eagle fatalities anticipated for the AEWRA is unlikely to cause an unstable or declining population in the region.

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